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SMITHSONIAN DEPOSIT.

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Pittsburgh

THE UNITED GAS IMPROVEMENT COMPANY,

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THE STANDARD DOUBLE SUPERHEATER

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OF

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AFFORDING { PERFECT CONTROL OF GENERATOR FIRE CONDITIONS.

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THE AMERICAN
GAS LIGHT JOURNAL

VOL. XCVI., No. 17. NEW YORK, APRIL 22, 1912. WHOLE NO. 1,924.

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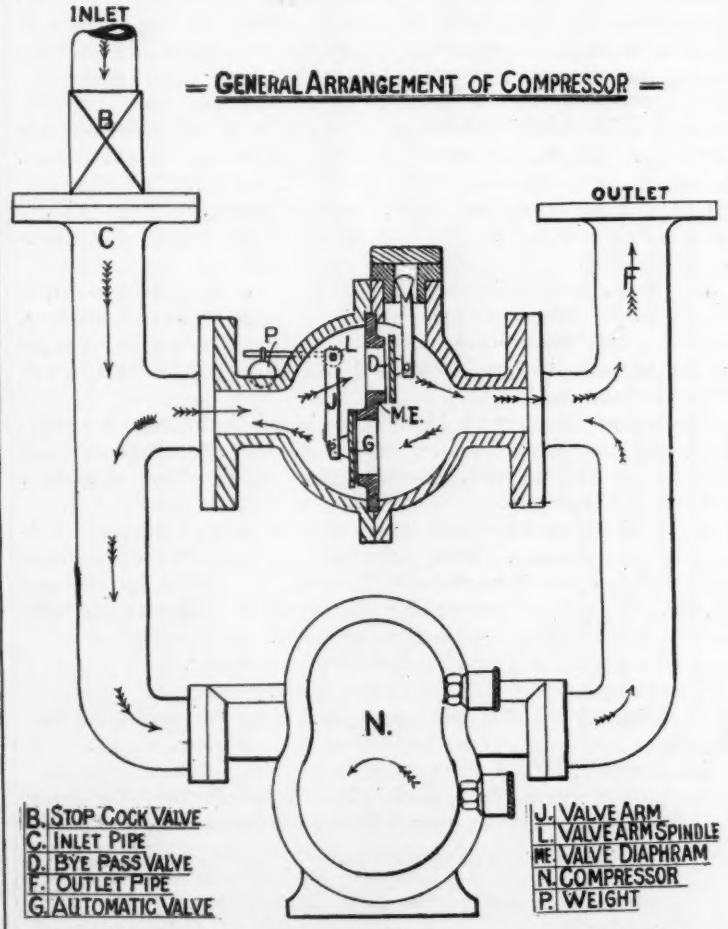
High Pressure Gas Lighting.

[Communicated by MR. B. G. GLOVER, of THOMAS GLOVER & Co., London, England.]

Some 9 years ago our attention was first called to the application of high pressure gas to lighting. Its possibilities at once appealed to us and, having made exhaustive trials with the various systems then on the market, finally decided upon the Sale-Onslow system, which, in our opinion, embodied the best features from every standpoint. This system, which had already been given a thorough trial in the Government Arsenal at Woolwich, the largest institution of its kind in the country, proved so thoroughly satisfactory that it was almost universally adopted for all the Government Arsenals. We were so impressed with the results obtained that we applied for and secured the license for the manufacture and sale of the lamps, burners, compressors, etc., under the Sale-Onslow patents, and our first undertaking was to light our own works by this system. Possibly a description in detail of this installation, together with the results obtained, will be of some interest. In addition to lighting, we have now applied high pressure gas to many other purposes and our present installation may be divided under three heads: 1, Lighting; 2, tinmens' pots; 3, muffles, melting pots, brazing burners, etc. It is proposed to deal with each of these heads separately, first of all, giving a general description of the compressor or pressure raiser.

Compressor.—This consists of a rotary blower, fitted as a rule with a fast and loose pulley, so that it may be driven by a belt from existing shafting, while, in some cases, it is coupled directly to a small, independent gas engine, or electric motor, the whole being mounted on a common bedplate. Above the blower is a combined non-return and byepass valve, connected to the blower by cast iron side pipes, as shown in the sketch herewith. The action of the compressor is as follows:



GENERAL ARRANGEMENT OF COMPRESSOR

The inlet cock *B* is opened and the gas passes down the inlet pipe *C* directly into the valve casing, through the by-pass valve *D*, which is so arranged that, under the action of gravity, it hangs slightly clear of its seating, then to the outlet pipe *F*, and so to the burners. This enables the burners to be lighted at low pressure; and, further, insures a partial light, should the compressor at any time break down. The compressor when put in motion draws the gas down the

inlet pipe and forces it under pressure through the outlet pipe to the burners. While the plant is in action the automatic valve *G* acts as a governor and deals with any excess pressure in the following manner:

Let us say that a pressure equivalent to 50 inches of water is required and the burners are set to suit this pressure. The valve *G* is adjusted accordingly by altering the position of a sliding weight *P* on an arm, which is attached to the spindle *L* carrying the valve. As soon as the pressure of 50 inches is exceeded in the outlet pipe (valve *D* now being closed), the valve *G* opens and allows the excess pressure to pass back again into the inlet pipe, thus insuring one constant and steady pressure whatever the number of burners in use. For our own lighting installation we maintain a pressure of 56 inches of water at the outlet of the compressor. Below we give details of the 5 sizes of compressors that are made:

Size of Compressor.	Revolutions per Minute.	Dia. of Pulley. Inches.	Face of Pulley. Inches.	Horse Power Used.	Capacity in Cubic Feet per Hour.	Size of Inlet and Outlet. Inches.
000.	600	3½	1¼	0.50	250	¾
00.....	550	4½	1½	0.75	500	1
0.....	450	6	2	1.25	1,000	2
1..... ..	400	11	2¾	2.00	2,500	3
2.....	350	13½	2¾	3.50	5,000	4

The above capacities are maximum capacities for a constant pressure of 56 inches of water at the outlet, and should be modified if a higher pressure is required.

Lighting.—We have a separate installation for lighting our factory, the details of which are as follows:

(a.) *Size of Compressor.*—No. 1, as above.

(b.) *Supply.*—Three inches to the inlet of the compressor from a 500-light dry meter fixed 150 feet away.

(c.) *Service.*—The main service is 2 inches with ¾ inch branches.

(d.) *Lamps.*—In the majority of cases the burners are situated where there is an absolute absence of either draught or dust, and the lamps are, therefore, of very simple construction, merely consisting of a circular, convex reflector, which is 24 inches, 18 inches or 12 inches in diameter, according to the size of the burner, having a circular hole in the center, through which a cylindrical glass is inserted from above, the latter being provided with a flange or lip to support it. In the brass and iron foundries, where, of necessity, there is always a considerable quantity of steam or dust, or both, we use an enclosed arc lamp. The air, both to support combustion and for ventilation, is brought in through the head of the lamp, and these inlets are protected with copper gauze, which, when necessary, may easily be removed for cleaning. In this way the life of the mantles is considerably increased.

(e.) *Burners.*—The burner is constructed with a turbine-shaped distributor, which, imparting a circular motion to the air and gas, ensures a constant mixture. The air adjustment plate is so arranged as to give a constant proportion, and can be set without in any way disturbing the mantle.

Number of Burners in Use.—Three hundred, 500 candle power; forty, 250-candle power; sixty, 120-candle power. These burners provide not only a good, general light, but also local light over benches and machines.

(f.) *Anti-Vibrators.*—Each lamp is fitted with a properly constructed anti-vibrator. From experience we have found this most efficient in keeping down the cost of renewals, both of mantles and glasses. In addition to absorbing all vibration it enables the lamp to be turned or swung for cleaning purposes.

(g.) *Total Candle Power of Installation.*—167,200.

(h.) *Consumption.*—4,200 cubic feet per hour.

(i.) *Efficiency.*—39.8 candle power, for every cubic foot of gas consumed.

(j.) *Area Lighted.*—4 acres.

(k.) *Comparison.*—We append below the comparison of the cost for 1,000-candle power per hour with various forms of lighting:

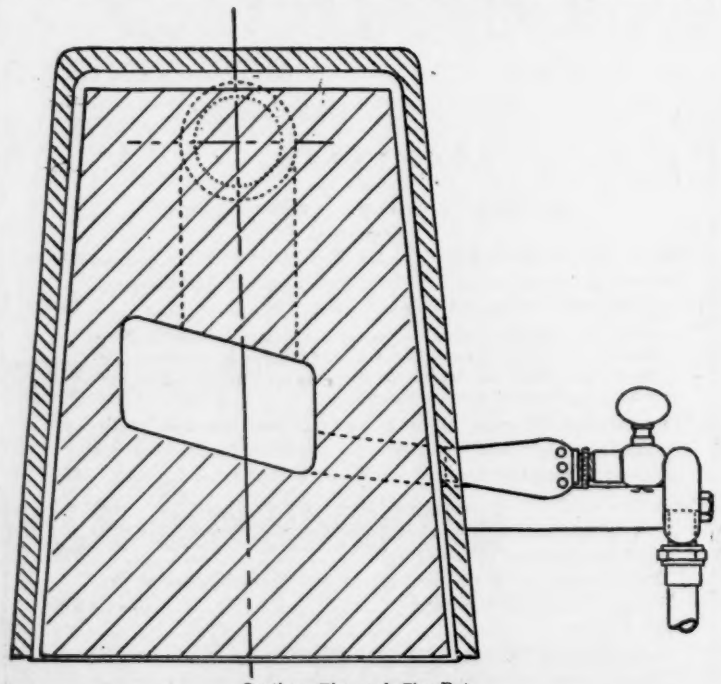
Electric incandescent (for current)..	1s. =	25 cents.
Electric arc lamps (for current).....	2d. =	4 "
Ordinary incandescent (for gas) ...	1½d. =	3 "
This system.....	0.9d. =	$1.80

In our calculations we have charged electric current at 3d. (or 6 cents) per unit, and gas at 3s. (or 75 cents) per 1,000 cubic feet, which are about the mean prices charged in this country. We would call your special attention to the fact that the above figures are in every case taken from our own personal experience, gained over a period of about 8 years.

(1.) *Summary of Cost.*—We append below two extracts taken hap hazard from our records, giving cost per lamp per hour:

Items.	Cost.	Cost.
Attendance.....	.042 cents.	.044
Gas consumption	.714 "	.762
Mantles.....	.146 "	.070
Forks	.016 "	.008
	.918 "	.884
Total number of lamp hours on which calculation is based.....	21,850	40,170

(a.) *Tinmen's Pots.*—In this installation the details of the compressor, the supply and the service, are precisely similar to those given under "Lighting." For this installation we maintain a pressure of 90 inches of water at the outlet of the compressor.



Section—Tinman's Fire Pot.

(b.) *Tinmens' Pots.*—This consists of an outer cast iron casing and an inner, cone shaped, fireclay brick. Two burners, each controlled by a separate cock, are fitted at the side of the pot, the nozzles just entering two holes provided for that purpose, and which lead to the recess provided for the irons. This recess, which is large enough to take two irons, is at an angle sloping down towards the burners, the idea being that, when the lower iron is removed from the hottest part of the pot, the second iron rolls down by gravity to take its place. The position of the burner is so arranged that it plays on to the butt, not on the tip, of the iron. In this way the tinning is preserved and the iron does not require re-pointing so frequently; 300 of these stoves are in use.

(c.) *Consumption.*—With both burners lighted the consumption per hour per pot is 11.5 cubic feet, or 3,450 cubic feet for the whole installation; but when the pot is once thoroughly heated up one burner is sufficient to maintain the temperature, making the consumption per pot 5.75 cubic feet per hour, or a total for the whole installation of 1,725 cubic feet.

(d.) *Comparison.*—Before the introduction of high pressure gas we for many years used charcoal. Comparing the cost of the gas used in October, November and December, 1911, with the cost of charcoal used during the same 3 months in a previous year, the ratio is as 3 is to 4, or a saving of 25 per cent. by the use of high pressure gas; and this, in spite of the fact that our output of meters during these 3 months of 1911 was 15 per cent. higher than during the same period of the other year under discussion.

Other advantages in favor of gas are: Cleanliness; convenience: control of the whole installation from the compressor: saving of men's time, because at the beginning of the day the pots are brought to a working temperature in a few minutes.

(a.) *Muffles, Melting Pots, Brazing Burners.*—The gas for these various pieces of apparatus is supplied by the same compressor as that which supplies the tinmens' pots.

(b.) *Muffles.*—We use these exclusively for case-hardening tools etc.; and, to mention some of the many advantages, the heat is con-

stant and is easily controlled, and the required temperature is obtained in a very short space of time.

(c.) *White Metal Pots.*—We have found that a properly constructed burner and pot gives most economical results when used for the purpose of melting down white metal, lead, solder, etc., having the same advantages as mentioned above in the case of muffles.

(d.) *Brazing Burners.*—These consist of a high pressure heating burner, fitted with a handle, and a length of flexible metallic tubing. The use of high pressure gas for this purpose is far more efficient than low pressure gas in conjunction with air blast, and, in addition, has this very distinct advantage; with the former only one service for the gas is necessary, the burner being provided with an injector which draws the proper proportion of air from the atmosphere, while, with the latter two services (one for low pressure gas and the second for air under pressure) are necessary.

In conclusion, we trust the above descriptions of our installations of high pressure gas will be of interest to you. We would again repeat that this is a record of our actual experience, and we may say that we ourselves are more than satisfied, not only with the saving in cost, but also with the greater convenience and added facilities that high pressure gas in its various forms has brought us.

[Official Report Furnished by the Secretary—Continued from Page 261.]

FORTY-SECOND MEETING, NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

Held in Young's Hotel, Boston, Mass., Feb. 14 and 15, 1912.

Second Day—Morning Session.

Discussion on the Barnes Paper.

The President—I understand Mr. Joyce, of the local gas company, is here, and has something we would like to hear on this subject.

Mr. Joyce—I do not know that I have much to say on the subject, except along the line of work we have been doing in Boston. We have been following this business for some time, and have met with considerable success. We have a number of good size installations, among which will be found soft metal melting, japanning, hardening and annealing. We have one very large incinerator here at the "Animal Rescue League." This was originally built to burn fuel oil, but we finally managed to bring it over to gas, burns up from 600 to 900 pounds of dogs and cats per day, and is doing the work splendidly and economically. This installation has been in for 2 years, and is giving excellent results. We have also some good installations of large baking ovens, one concern alone having installed five reel ovens, and we are constantly having inquiries in answer to our advertising. I call to mind a case of metal melting. This installation has been in for 1½ years. The capacities of the pots (two in number) are 2,200 pounds each of soft metal, and they have worked out very successfully. The owners found they could do three times as much work by the use of gas, than with the old method using coal. A large chemical manufacturing concern, which make a product similar to Sulpho-Napthol, in the last 2 years or more have installed 5 kettles of large capacity. They formerly burned wood under the old kettle, but the introduction of gas has enabled them to do four times as much work as formerly, and with less help. Their manager assured me that he would not go back to the old method under any circumstances, as he now had a consistent heat, always perfectly under control, which was very necessary to him. We have succeeded in interesting a number of the hospitals in ranges and gas ovens, and they are giving satisfactory results. The getting of fuel installations of any size represents a great deal of hard and persistent work on the part of gas companies, but I am sure that, the installations once secured, this will prove an excellent source of revenue. I believe gas companies should give this work a great deal of attention, and I also believe that the future will show a very much larger return, since I think that gas companies, beginning to realize the importance of this business, are going after it systematically.

On motion [seconded] the Secretary was requested to send the thanks of the Association to the writer of the paper.

More from the Question Box.

The President—We now are down to the scrap basket. Will the Secretary please give us the different conundrums?

The Secretary—I thought he was going to refer to me as the scrap basket. The first query is:

> "The Pitot tube: to what extent do gas companies use same to determine the actual flow of gas in mains?"

Mr. White—One thing that I know positively about the Pitot tube is it would be a very good thing if we had one to use. Whenever the pressure drops off in a certain section, it is desirable to know the cause at once. After assuring ourselves that there is no obstruction in the mains, and from our consumers' ledgers finding out the gas consumption for the corresponding period during the preceding year, and from computation determining the quantity of gas a main should deliver per hour, we still are ignorant of the actual flow of gas in the particular main in question. We have a tube; but have been having a great deal of trouble in finding a gauge that would record differentials, but have not been successful yet. The last word[1] upon the subject I believe was given by Mr. Battin (of Detroit) at the American Gas Institute in 1911. We had encountered some of the same troubles that he spoke of in his paper, and as he overcame those troubles we hope in time to be able to do the same, and actually find how much gas we are sending out through a certain main at a certain time of day. We believe this will be a great help in planning future installations and giving good service.

The Secretary—The next question is:

> "Proper temperature of the carburetor and superheater for proper gasification of the enricher in water gas plants, and what experience members have had in using pyrometers to obtain this temperature?"

The President—Is Mr. Ramsburg in the room? Has anybody had any special experience in this line that he would like to make public?

Mr. Norcross—I did not come prepared to say anything on this subject, and I don't remember my figures, so that I cannot give a detailed formula, but I do think that somebody ought to be willing to get up and say that he uses pyrometers regularly in all of his water gas apparatus. It is perfectly feasible to do it, and it is the greatest help in the world to do away with these unexplainable changes in oil results from day to day. Perhaps for an hour or two in the night, or when nobody is looking, the heats have been let go to the dogs by turning the oil into lampblack. We have been using pyrometers for some years in New Haven and found them a great help in water gas plants. The temperatures, of course, are varied, recording what we found necessary in the working of the oil. With one oil we use one temperature and with another another; but I forget just which oils go with which temperatures, so I won't attempt to give any specific figrues on that side of it.

The Secretary—I would say, as representing the other end of this scale, the rule-of-thumb operation, that since installing pyrometers we have maintained a more uniform line on our oil efficiencies, and I think it has paid.

Mr. Bird—Pyrometers had been used in Fall River before my day, and we are using them now, and I don't think we could dispense with them. I think they are invaluable to any company that makes water gas, because I think the matter of the proper temperature is everything in the efficiency of the gasification of oil. You must have a certain temperature in your carburetor to vaporize your oil, and you cannot get the proper oil efficiency unless you have the proper temperature in the superheater to fix it. Moreover, I think recording pyrometers are invaluable, inasmuch as you have an absolute check upon the efficiency of your operator. Your recording pyrometer will tell you through the 24 hours exactly what temperatures are being kept. We are using pyrometers both in our carburetor and superheater. We use a pyrometer at the top of the latter and at the bottom of the former with our oil, which is Texas oil of about 35° B. gravity. We carry a temperature in our carburetor of about 1,400°, and a temperature at present in our superheater of 1,300°, which temperatures have been found experimentally the most efficient. I think in warmer weather you can run lower temperatures, when it is possible to run as low as 1,260° on our superheater. I think there is a certain saving in doing that, as my figures yesterday would show.

Mr. Kennedy—I have never used the pyrometer, but it has often occurred to me how long the efficiency of the pyrometer lasts. In other words, a great number of us undoubtedly have to run an apparatus accumulating, from time to time as we go on, a certain amount of carbon in the set. We all do that. Probably some may say they don't, but they do. Now, as that carbon accumulates, your heating surface is not so effective for gasifying and fixing your

1. See Journal, March 12, 1912; p. 149: "The Flow of Gas in Mains."

oil, so that the recording pyrometer record (it does seem to me) must give a reading which has a diminishing value as your set carbonizes. I can appreciate that it must have a very great value, all told; but is there not that dangerous feature about it? While on the subject I would ask if Mr. Norcross or Mr. Bird or anyone else here is using a recording CO_2 apparatus. It seems to me that should be a very valuable piece of cheap apparatus.

Mr. Norcross—We have never had any experience with the recording CO_2 apparatus; but, with reference to Mr. Kennedy's objection that the carbonization of the bricks necessarily requires a higher temperature, and that it would be dangerous to get in the habit of using a fixed temperature actually measured, I would say that all he has to do is to tell the man to carry 20° higher, or 50° higher, as the working of that apparatus and the results and his own observation will show is necessary. When the head and brains of the works determines that a certain temperature is necessary, he can order a very ignorant man to keep that temperature, and that man can do it. His temperature is recorded continuously for his whole shift. It is, I think, indispensable to uniformly good working.

Mr. Bird—I would like to say, as far as Mr. Kennedy's question is concerned, that a pyrometer is a pretty accurate instrument, if you use it right. Personally I standardize our own pyrometers. I have one pyrometer that I at times send to the Bristol Company—we use Bristol pyrometers—and have them standardize the box and a fire end with it. I keep that box with that fire end, and a given length of connection, for no other use than standardization, and I try as far as time will allow to standardize our pyrometers regularly once a week. Moreover, once you determine what is the proper temperature to carry in your superheater and your carbureter, you have a very ready check upon the correctness of the temperature. If you watch your seal pot you can tell quite readily if anything should go wrong with your pyrometer. If the temperatures are too low you get oil in your seal pot, and if too high you get carbon, and both show very plainly. So I think there is no very great danger in running at a fixed temperature on the pyrometers. I think an optical pyrometer, speaking of pyrometers, is a very good thing to have. We use a Waner. You can use it as a check upon your other pyrometers; and, moreover, in connection with your generator fires I find that it is of great value. I tried to show in my paper yesterday that certain temperature limits in your generators are most efficient, and by the use of an optical pyrometer you can regulate the blow and the run so as to get very close to those most efficient temperature limits.

Mr. Kennedy—I always understood that a feature of the pyrometer was to save somewhat the formation of carbon on the brickwork, or to gasify your oil as it ought to be gasified. Now, I hear men who are using pyrometers say that, as the brickwork fills up with carbon, you must increase the temperature at which the pyrometer should work, and we who have been looking at the seal-pot for the last 30 years to find the oil, have got to do that with a pyrometer!

Mr. Norcross—I presume I have got to take that as a personal accusation. I have seen oils which gave very much higher efficiency when making a little carbon all the time than they would when making none, and if I find such an oil and find such a condition, I should certainly not hesitate to plug up my checkerbrick. It is just a question of dollars and cents.

Mr. Bird—I would like to say that the matter of plugging up your checkerbrick with carbon, if you do make any, and you generally do, I think can be very readily dispensed with, and without loss in time as far as operating conditions are concerned, because, when you clean and clinker in the morning, as we do, it is a very easy matter to disconnect your hot valves and close both of them, thereby separating your carburetor and superheater entirely from the generator while cleaning it, and open your carburetor blast valve and burn off that carbon.

Mr. Morrison—Just to emphasize that point. That scheme has been in successful use for a good while, but it is wise not to wait 2 or 3 months after you have started up a clean set before you start burning off carbon in that way. In other words, start it right away, the very next day after you start your machine, and keep the carbon off; don't wait till it is plugged up before you try it.

The Secretary—I would like to ask Mr. Bird about the standardization of his pyrometers; how much he finds them off ordinarily; so we who do not have time to do it every week can give some guess as to how near ours are.

Mr. Bird—I find that my pyrometers will vary as much as 40°, 50° or 60°. One objection that I have to the Bristol pyrometer is that it has a very high resistance couple. You take one fire end and couple it up with one box and it won't give you within 50° or 60° the temperature that you will get with another fire end using the same box. You can readily determine that difference, however, if you have one instrument that is standardized.

The Secretary—The scrap basket is not quite empty yet. Here is another query:

> "Riveted steel main pipe, placed between condensers and rotary outlet, and, again forming the main inlet line in the purifier house having been in use 3 years, suddenly develops signs of pinholes, which, later on, grow to such an extent as to necessitate a change to cast iron pipe. The wasting away of the steel metal occurs from the inside toward the outer surface. Has anyone experienced similar troubles with steel pipes, and were cause and remedy found for same?"

Mr. Kennedy—I am responsible for that long question. We have had a pipe, as said there, running 3½ years, which depreciated most extraordinarily. In fact, the whole thing will have to come out about as quick as we can get it out. I have asked Mr. Haddock to work on that from the chemical end for quite a little while. He has some data which might or might not be of interest. It was suggested to me that it might be electrolysis discharging from the metal of the pipe into the liquor which is in the pipe and so dissipating itself into the seal pots. I have not as yet gotten on to that, but we have tried a good many kinds of metals, as Mr. Haddock will explain, placed in different solutions, which give what to us are very wonderful results. We have had our dump-hole bolts on the purifier boxes go with no head on them at all, absolutely nothing holding the dump-hole excepting the red lead and the neatness with which the bolt was fitting its hole. We don't find any depreciation on the cover of the box to speak of at all, but the steel pipe, which is ⅝ inch thick, has gone through inside of 3½ years. In one length we took out last autumn you could take off the inside of the pipe in laminations like slate or like mica. We don't know whether it is a question of the metal to some extent or a question of the type of gas that we are making, or what, but I did feel that it was of such vital importance to us that it might possibly scare some of the others when they go back to their works to see whether theirs is acted on. And if anybody has had a similar experience I would be very glad, Mr. President, to know something about it. As I say, Mr. Haddock has some data. If it interests anyone he will be glad to give it to you.

Report of the Committee on Memorials to Deceased Members.

The President—Are the Committees appointed to draft resolutions on our deceased members ready to report?

Mr. Norcross reported for the Committee on Mr. F. C. Sherman:

We learned with deep regret of the death of our esteemed friend, and charter member, of the New England Association of Gas Engineers, Freeman C. Sherman, of New Haven, Conn., which occurred in New Haven on Monday, December 11, 1911.

He spent his entire life in the gas business, first at Ware, Mass. From 1858 to 1859 as Superintendent at Newport, R. I.; from 1859 to 1870 he was General Manager at Brookline, Mass.; from 1870 to 1875 in the same position at Worcester, Mass.; and from 1875 to 1903 was Engineer and Superintendent at New Haven, Conn. Since 1903 he has been the Consulting Engineer of the New Haven Gas Light Company. For more than 53 years he was active in the gas business.

He was a member of the Society of Gas Lighting, an honorary member of the Guild of Gas Managers, also a member of the American Gas Light Association, and later of the American Gas Institute, and a Director in the Meriden (Conn.) Gas Light Company since 1877.

He was a genial, pleasant man to meet. His good judgment and wide experience made him one whose opinions and advice were sought on matters connected with the gas business.

He was one of the last of those whole-souled, able men, who, without technical training, contributed so largely in placing our profession on a firm foundation.

To his family this Association extends heartfelt sympathy.

J. Arnold Norcross,
Chas. A. Learned,
William Anderson,
} Committee.

Mr. H. C. Crafts submitted this resolution on Mr. Manchester:

Whereas, The Creator, in his Divine wisdom, has called, in the fullness of his years, our friend and comrade, George L. Manchester, to his eternal home. We hereby take this opportunity to express our appreciation of our loss and also of him as a man and associate.

He was one of the oldest members of this Association and was a regular and faithful attendant at its meetings.

H. C. CRAFTS,
S. J. FOWLER,
C. S. SPAULDING, } Committee.

Mr. W. A. Wood presented the following minute over the late Frederick P. Addicks.

Frederick P. Addicks was elected to Associate membership in 1893. As Treasurer of the Boston Companies (from 1887 to 1899) his business tact and genial personality won the respect and esteem of his co-workers in the industry and the patrons of the Company. He removed to New York in 1899, but retained his membership in the Association. He died November 2, 1911.

WILLIAM A. WOOD,
WALTER G. AFRICA,
HARRY A. NORTON, } Committee.

Captain W. E. McKay submitted the following report on the death of Mr. O. F. Greim:

Mr. O. F. Greim died in Milwaukee, June, 1910. Mr. Greim joined the New England Association, in 1901, when he was Superintendent of the Everett Works, New England Gas and Coke Company, and he always held his membership in high regard. Subsequently he was Superintendent of the Dominion Works, at Sydney, Capt. Breton; and at the time of his death he was General Manager of the Milwaukee Coke and Gas Company.

In his professional work Mr. Greim was very successful, and displayed marked skill in organization and administration, and in the expedient adaptation of invention to commercial needs. He was retiring and reticent, but his close friends appreciated the charm and sterling worth of his character and attainments; he was a facile artist, an entertaining narrator, a rare companion; an active, helpful and sympathetic associate; his alert intelligence and his genuine warm-heartedness endeared him to all who had the good fortune to see him often and to know him well. His unexpected death was a heavy loss to the industry with which he was so long connected.

W. E. MCKAY,
A. K. QUINN,
W. H. SNOW, } Committee.

The President—Gentlemen, you have heard the reading of these just and very touching memorials. What is your pleasure?

Vice-President Barnum—I move, Mr. President, that copies of the memorials be sent to the families of the respective deceased members, and that they be presented in the minutes of the meeting.

The President—It is moved and seconded that they be received and placed on the records, and that copies be sent to the families of the deceased members. [Adopted.]

Mr. Haddock—Mr. President and Gentlemen: If I may be allowed to read a short report that I made on the corrosion problem in Cambridge. The inlet steel pipe to the purifying boxes, the iron beams and the tie rods are eaten so that they must be renewed. When the plate on the end of the inlet main was removed it was noticeable that the deposit was much deeper in the section of steel pipe than in the sections of cast iron pipe, and the sludge in the cast iron pipe was very soft and slimy compared to that found in the steel pipe. This was due to the more rapid action on the steel than on the cast iron. The following analysis shows that the sludge taken from the steel pipe had much more iron in it.

Analysis of Sludge.

Content.	Steel Pipe.	Cast Iron Pipe.
Moisture	19.0 per cent.	28.8 per cent.
Iron oxide	53.0 "	23.0 "
Sulphur	14.6 "	7.6 "
Cyanogen	1.6 "	0.6 "
Ammonia	6.3 "	5.9 "
Carbon	8.4 "	5.5 "
Carbon dioxide	1.2 "	1.5 "

In the sludge from the cast iron pipe there was a large amount of light oil and naphthaline. The presence of carbon with the impurities, such as cyanogen, 108 grains; sulphureted hydrogen, 300 grains; sulphur compounds, 20 grains; 1½ per cent. carbon dioxide and traces of ammonia, starts small galvanic cells and the metal begins to pit. As the iron changes into the various compounds it acts like sponge and the area of corrosion increases in size. Two years ago we found the top of the tubes in our primary condenser coated with the same sludge, and at this point the tubes were eaten so that they had to be renewed. The lower part of the tubes seemed in good condition, as there was enough condensation on them so that the carbon was continually washed off. When the new tubes were put in a baffle-plate was placed in the inlet end of the condenser, so that all the gas had to go to the top of the tubes and condense there. We find on examining these new tubes, after having been in use longer than they were the first, that there is no hard deposit on the top. Some action is going on, but it is evenly distributed over the tubes. I put strips of different metals in the sludge taken from the cast iron pipe, for 6 days, at a temperature of 120° F. Steel lost 13 per cent. of its weight; American ingot iron, 3.1 per cent.; cast iron, 2.3 per cent.; Toucan metal, 6.2 per cent. This shows that if a metal cannot be protected cast iron should be used, the slower action and the extra stock giving it a longer life. These metals were placed in a number of solutions for the same length of time, corrosion taking place in most of them when carbon was added; the action was usually increased. If you take some of the sludge and test it with a piece of iron, as one terminal and a piece of carbon as the other, you get a current. The sludge from the secondary condensers will not give a current, as it contains enough tar and oil to be a non-conductor. The tubes in these condensers have given us no trouble as yet, and have been in constant service since the apparatus was installed. I treated a piece of steel and a piece of American ingot iron with "Bakelite, and heated it to 250° F. for 10 minutes. These were kept in the sludge taken from the cast iron pipe for 6 days. No corrosion took place; in fact, they gained .03 per cent. and .06 per cent., due to the small particles of sludge which stuck to the uneven coating. The coating was not as smooth as we wished, due to haste and inexperience in preparation. Since that time we have given 10-foot bars a coat which was very smooth. Another coated piece was boiled for 10 minutes in ammonia liquor and showed no loss in weight, as it was placed in the inlet steam pipe to a pump which was running for 3 hours, and here it showed no change. I would recommend it as a protective coating for heater tubes and brass valves and cocks that come in contact with chemicals, especially ammonia. Two objections to its use are that it gives a brittle coat and it must be heated to 238° F. before it has these resisting qualities.

Per Cent. Loss in Six Days. at 120° F.

	Steel.	Am. Ingot Iron.	Cast Iron.	Toucan Metal.
Ammonia liquor	—	0.7	—	0.46
Am. liquor and Cabot's lampblack	0.15	—	0.35	5.75
Am. liquor and carbon from tar	—	—	0.34	3.89
Potassium sulphocyanide	0.14	—	—	—
Ammonium sulphocyanide	0.79	2.8	—	—
Ammonium and naphthaline	1.06	—	—	—
Boiled in am. sulphocyanide	0.19	—	—	—
Am. sulphocyanide and carbon from tar	0.59	—	0.59	2.52
Am. liquor and coke	0.16	0.12	0.10	1.30
Am. sulphocyanide and coke	1.50	2.59	0.21	1.06
Potassium cyanide	0.02	—	—	—
" and carbon from tar	0.03	—	—	—
" and coke	0.20	—	—	—
Sludge from inlet pipe to purifying boxes—cast iron	12.95	3.1	2.33	6.1

In some of our boxes we have had to renew the iron bars. This last time we have treated these boxes with this vapor, which is an insulating material, and which, after it has been heated to 250°, seems to resist the action of practically all chemicals, and are going to try this out to see if we can save a little iron.

ADJOURNED.

The President—Gentlemen, the time has arrived for the meeting to close. I wish at this time to thank you for your great interest and your loyal support, without which it would be impossible for anybody to run a decent meeting. I wish you a happy and a most prosperous year. [Applause.]

The Association then adjourned.

Flow of Gas Formulæ, Derived, Analyzed and Checked by Experimental Data, with Diagrams for Figuring the Flow of Gas in Street Mains and Services.

[Prepared by MR. J. M. SPITZGLASS, for the Eighth Meeting, Illinois Gas Association.]

Part 1.—General discussion of the fundamental principles involved in the derivation of the standard formulæ for the flow of gas in pipes. Analysis of the formulæ, and their application to experimental data. The general equation, and its graphical solution for high and low pressure gas mains.

Part 2.—Tests on the flow of gas in service pipes. Experimental data and results obtained by graphical analysis. Equivalent length

of fittings. Equations determined for service pipes and chart for their solution. Consideration of altitude in services.

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(1.) INTRODUCTION.

In determining the proper sizes of mains for the efficient distribution of gas through a given system, the solution of a gas flow formula does not answer the purpose. First, it is not certain that the one selected from the multitude of formulæ was meant to include all the sizes in question; and, second, the numerical values of the quantities necessary for the solution of the formulæ are not always given. Most of the quantities involved, as the initial pressure, allowable drop, and the margin of capacity, have to be assumed, and it is necessary to observe the relation of the quantities to each other in order to make the proper assumptions.

To facilitate the necessary manipulations in this matter, the writer computed a set of diagrams for the graphical solution of equations derived for the flow of gas in pipes of all sizes. The derivation of the equations, as given in detail in this work, is based upon the fundamental principles of motion of fluids in pipes, and is checked by experimental data furnished by the Engineering Department of the Peoples Gas Light and Coke Company, of Chicago. The Drafting Department of the Company produced the diagrams for calculation of the flow of gas in high and low pressure gas mains, and also in service pipes. These diagrams were constructed to give a ready solution for all practical problems concerning the capacity of gas mains, also to show a graphical outline of the quantities involved in the equation. Each quantity is represented by a set of straight lines emerging or following from the origin of the diagram, so that the change produced by the variation of a given quantity is shown by its relative advancement from the origin either in the horizontal or in the vertical direction.

In the following chapters, embodying the derivation of the equations used in the computation of the diagrams, a summary of the fundamental principles is briefly stated, leading to the development and analysis of the standard formulæ, and followed by a graphical determination of the co-efficients from the given experimental data.

(2.) THE FUNDAMENTAL EQUATION.

The various, so called, hydraulic formulæ, for figuring the flow of gas or any fluid, from one vessel to another, are based upon the well known principle that motion or velocity of a body is an exact equivalent to a corresponding drop in pressure, or fall from height of the same body. This physical statement is usually expressed in the form of an equation:

$$\frac{V^2}{2g} = H \ldots \ldots (1)$$

in which V. is the velocity of the fluid in feet per second; H. the difference of level in feet, or equivalent change in pressure from the state at rest to the state of motion of the same fluid; g. acceleration per second produced by gravity and equal to 32.2 feet.

(3.) ORIGIN OF FUNDAMENTAL EQUATION.

The origin of equation 1 and the relation of gravity to the flow of a fluid, can be explained as follows:

Motion, or velocity, is one of the various forms of energy which can be possessed by a material body. In order to impart velocity to a given body, it is necessary to go through the natural process of acceleration, or change of motion. This process, or action, requires the expenditure of an amount of energy equal to the force applied times the working distance. This accelerating force is numerically equal to the mass of the body times its acceleration, and the working distance is equal to the total space through which the body has been accelerated. The work expended, or kinetic energy imparted to the moving body, is therefore equal to:

Mass × acceleration × distance.

Now, the acceleration is equal to:

$$\frac{\text{Final velocity,}}{\text{Time}} \text{ (initial being zero)}$$

and the total distance is equal to:

average velocity × time.

The kinetic energy is therefore equal to

$$\text{Mass} \times \frac{\text{Final velocity}}{\text{Time}} \times \text{average velocity} \times \text{time}$$

$$= \text{Mass} \times \text{final velocity} \times \text{average velocity.}$$

For uniform acceleration, average velocity is equal to ½ final velocity, and the kinetic energy is equal to:

$$\text{or kinetic energy} = \tfrac{1}{2} \text{ Mass} \times \text{velocity} \times \text{velocity}$$

$$\frac{1}{2} MV^2 \ldots\ldots\ldots\ldots (2)$$

The conception of mass, however, is not so familiar as the conception of weight. Mass is the amount in a given body, independent of gravity, and weight is the force which the mass possesses by virtue of gravity, or $W = Mg$; but weight being more familiar than mass, $\frac{\text{weight}}{\text{gravity}}$ is used instead of mass. Substitute, $\frac{\text{weight}}{\text{gravity}}$ for mass in equation 2, we have:

$$K.E = \frac{WV^2}{2g} \ldots\ldots\ldots (3)$$

When the accelerating force is the weight of the body W, then the distance of action is the height of fall or difference in level H and the energy expended is W times H (force times distance). Since the velocity acquired is the same, whether done by gravity or by any other equivalent force, therefore:

$$K.E = \frac{WV^2}{2g} = W H$$

Removing W, from both sides we have:

$$\frac{V^2}{2g} = H \text{ which is the form of the equation (1).}$$

(4.) PRESSURE, HEIGHT AND DENSITY.

If, instead of H, the height of fall, or difference of level column, we have given the equivalent difference in pressure in pounds per square foot. Then, this pressure is equal to the height of the column in feet multiplied by the weight of 1 cubic foot of the fluid in pounds, or $P_2 = H_2$ and equation (1) is changed to the form of

$$\frac{V^2}{2g} = \frac{P_2}{J} \ldots\ldots\ldots\ldots (4)$$

Where P_2 is the difference in pressure between the two vessels in pounds per square foot, and J is the density of the fluid in pounds per cubic foot. Equation (4) is often given in the form of

$$\frac{V^2}{2g} = \frac{P_1 - P_2}{J} \text{ or } V = \sqrt{\frac{(P_1 - P^2)\, 2g}{J}} \ldots\ldots\ldots (5)$$

Where P_1 and P_2 represent the initial and final pressure of the fluid respectively. However, the other form is more convenient and will be preferred.

(5.) FRICTIONAL RESISTANCE IN PIPES.

When the two vessels, containing the fluid under different pressures or levels, are connected together by a pipe of some length, a force, usually termed frictional resistance, is set up against the flow of the fluid in the pipe. This force balancing a part of the driving column or pressure, invalidates the latter from being transferred into motion or velocity. If the pipe is of considerable length, the resisting force may balance the greatest part of the driving column, leaving but a small percentage to be changed into motion.

As a result of the frictional resistance, the drop of pressure between the two vessels is practically divided into three parts. One part, termed skin friction, is used up in overcoming the resistance offered to the flow at the surface in contact with the solid walls of the pipe; another part, termed internal friction, is overcoming the resistance offered by the viscosity of the fluid which comes from the particles rubbing against each other while moving at various speeds through the same section of the pipe. The third part is the amount of pressure changed into the velocity of the flow, which form equation (4):

$$P_2 = \frac{V^2}{2g} J \ldots\ldots\ldots (6)$$

A great number of experiments were made by various authorities in order to determine the relation between the friction and velocity parts of the drop in pressure caused by the flow. The two parts of friction drop could not in practice be separated from each other, and, in order to establish some working basis for figuring the friction loss as a function of the velocity of the fluid, it was necessary to consider the total as skin friction only. It was found by experiment that the drop in pressure due to friction, other things being equal, is:

1. Directly proportional to the density of the fluid.
2. Very nearly proportional to the square of the velocity.
3. Directly proportional to the amount of rubbing surface in the same size.
4. Increases with roughness of the surface in contact.
5. Independent of the pressure between the fluid and the walls of the pipe.

Changing the proportionality to an equation, we have:

$$Pf = KJV^2S \ldots\ldots\ldots\ldots (7)$$

Where Pf = friction drop, pounds per square inch;
K = a coefficient, to be determined by experiment;
J, density of fluid, pounds per cubic foot;
V, velocity of fluid, feet per second;
S, rubbing surface in contact, square feet.

Since the velocity drop (see equation 6) includes two of the variables, J and V, therefore, by changing the coefficient K to a specific constant f, the friction drop of pressure is made a function of the velocity drop, and equation 7 is changed to:

$$Pf = fp_2 S \ldots\ldots\ldots\ldots (8)$$

Where p_2 is the velocity drop, as given in equation 6.

(6) THE MEAN HYDRAULIC RADIUS.

By summing up the forces acting on the flow, a term, called the mean hydraulic radius, was introduced into the equation representing the resistance offered by friction. The physical significance of the term can be explained as follows:

Since we consider the total drop to be caused by skin friction only, therefore the amount of rubbing surface, or the area of resistance which holds back the flow of the fluid, is equal to the length of the pipe times its perimeter, while the working pressure to generate the flow is effective over the whole cross-section of the pipe. Now, if we increase the diameter of the pipe, the frictional resistance increases as the perimeter, and the amount of flow to be held back by this resistance increases as the area of the pipe; or the effect of friction over the flow decreases in proportion with the ratio of the cross-section to the perimeter in contact. This ratio is represented by a length $\left(\frac{\text{area}}{\text{perimeter}}\right)$ called the mean hydraulic radius of the flow, in proportion with which the effect of skin friction drops. When the length of the pipe, in proportion with which the effect of friction increases, is divided by the length of its mean hydraulic radius, the quotient is an abstract number, representing the resultant effect of friction, and replacing the rubbing surface S of equation 8. The mean hydraulic radius R, for a circular pipe is equal to $\left(\frac{\text{area}}{\text{perimeter}}\right)$

$$\frac{\frac{\pi}{4}d^2}{\pi d} = \frac{d}{4}$$

and equation 8 is, therefore, changed to:

$$Pf = F P_2 \frac{L}{R} = 4 f P_2 \frac{l}{d} \ldots\ldots\ldots (9)$$

where l and d are the length and diameter of the pipe in feet, and R represents the mean hydraulic radius of the pipe.

(7.) THEORETICAL EQUATIONS FOR THE FLOW THROUGH PIPES.

When we consider the flow of a fluid through a given length of pipe, where the initial and final velocities are practically the same, the total drop of pressure, as given in equation 9, is due to frictional resistance only. Substitute into that equation the value of P_2, the velocity drop from equation 6, we have:

$$p = 4f \frac{l}{d} \frac{V^2}{2g} J \ldots\ldots\ldots (10)$$

$$\text{from which } \frac{V^2}{2g} = \frac{P}{J} \frac{d}{4 f l}, \text{ or } V = \sqrt{\frac{29}{4f}} \sqrt{\frac{pd}{Jl}} \ldots\ldots\ldots (11)$$

$$\text{and} \qquad q = \frac{\pi}{4} d^2 v = \frac{\pi}{4} \sqrt{\frac{29}{4f}}\, d \sqrt{\frac{pd}{Jl}} \ldots\ldots\ldots (12)$$

$$\text{or} \qquad q = C \sqrt{\frac{pd^5}{Jl}} \ldots\ldots\ldots (13)$$

(*Continued on page 274.*)

THE AMERICAN GAS LIGHT JOURNAL

NEW YORK, MONDAY, APRIL 22, 1912.

[Special Editorial Correspondence, by Telegraph.]

FOURTH MEETING, SOUTHERN GAS ASSOCIATION.

JACKSONVILLE, FLA., April 19, 1912.

Here is a "flash" from Florida's Metropolis respecting the most successful gas convention yet held in Dixie. The "weather scout" at Jacksonville promised weather as fair as the roses that bloom here the year round, and right well did he guess, for 68° F. anywhere in the States sounds well in April. So under fair skies, with just a few prankish reminders of the fool's month, the fourth session of the Southern gas men, lined up numerically strong in the handsome convention room of the beautiful Hotel Seminole, to honor the call of the Association's President, Harry B. Hoyt, who of a verity fulfilled every promise made by friends during last year at Montgomery that he would prove a jewel as a presiding officer. You will have the newspaper accounts, the programme, the President's address, and a photograph of the latter, all of which should be at hand by to-night. I know these will likely not be of avail in connection with the story, but I mention it just as an assurance that your scribe was "scribing." That the youngster grows is proven by a gain of virtually 100 per cent. in membership since the tryst at Montgomery last year. That the gain will be maintained (in partial ratio at least) seems likely from the action of the Association in placing the initiation and dues charges on membership account for the first year at $5 instead of $10. The total membership, as of to-day, is 215. Many new faces confronted President Hoyt when the gavel fell at 10 A.M. of Wednesday, the centenary celebration (on Thursday and Friday of this week in Philadelphia), and the floods in the upper Mississppi district kept down the attendance. Again another "witholder" of the true is traceable to the politics of Texas (primaries and the like), which kept many good scouts from the Seminole. However, the "new recruits" showed up in splendid form, and waded into the discussions with nonchalance and stout argument. Davis, of Mobile; Maguire, of Tampa; Hunter, of Ocala; and Walker, of Beaumont—all mixed in the battle of minds in that state of mental equipoise that ever marks the veteran Gas Association member, Plenty of time was allowed each man in discussing the papers; and the members from the "little towns" were not overlooked. The President's address naturally bristles with practical ideas and plans for the advancement of the industry; and that he was in the affirmative is proved in the adoption of resolutions urging that all his suggestions be persevered with. The papers submitted were really high class and all brought out good debates. The banquet was brought off as per programme, with "Al." Kelley, as Toastmaster, and the "Only Rushin" surely did his greatest to further the meeting at Atlanta of the National Commercial Gas Association. From an early morning angle I think it safe to say that Mr. C. E. White, of Montgomery, Ala., will be elected next President. He is in every sense a good one. The boat ride to-day (Friday) with a shore dinner at Mayport will bring the convention to a close. As I am aware of your going to press hour, let me in closing this brief electric story say that the Jacksonville "gas scouts" simply shut up shop, and are giving their undivided and successful attention to the task of causing everyone to feel at home, and to enjoy to the full a most pleasant social programme. Our stenographer this year is of the sort that precludes any failure respecting an early and succinct report of the proceedings. I might in closing add that the JOURNAL seems quite a popular print down here.—E. D. B.

[Special Editorial Correspondence, by Telegraph.]

THE CENTENARY OF GAS AS AN ILLUMINANT.

PHILADELPHIA, PA., April 19th, 1912.

Just a paragraph or so to let you have some idea respecting the first session of the joint "Celebration of the Centenary of the Introduction of Gas as an Illuminant," now going on in the Hall of the Franklin Institute, under the auspices of the Am. Philos. Society, the Franklin Inst., Am. Chem. Soc., and Am. Gas Inst. Fair weather prevailed, over 300 were in attendance, and the proceedings were directed by Mr. Jas. M. Dodge, Vice-President. The attendance was certainly representative of the great industry, and a rapid glance over the hall enables me to name these prominent ones: W. H. Bradley, W. R. Addicks, A. H. Elliott, C. H. Nettleton, G. G. Ramsdell, F. Egner, Geo. Beadenkopf, W. C. Norris, F. N. Morton, C. F. Leonard, M. H. Spear, W. J. Welsh, F. D. Moses, C. M. Cohn, J. B. Klumpp, H. L. Rice, C. C. Tutweiler, A. E. Forstall, G. T. McBeth, and W. H. Gartley. These, however, will likely be sufficient to name as evidencing representativeness.

The paper (it was rather a very well put together lecture), by Dr. C. E. Munroe, Dean of the School of Graduate Studies, George Washington University, D. C., on "By-Products in Gas Manufacture." This really splendid work may not be mangled by telegraphic process; suffice it now to say, it was well worthy of the reputation of the man who delivered it. The exhibits (on the ground floor of the Institute) were really of interest and many in number. These include: Original gas burner, 1807; gas stoves made prior to 1850; set of burners, type of 1877; old meters, type of 1863; section of wooden gas main, Ravenswood, L. I., 1872; first copy AMERICAN GAS LIGHT JOURNAL; collection of drawings, prints, etc., of ancient gas plants; and so on. I should have said earlier that a very pleasing portion of Dr. Munroe's lecture was a handsome acknowledgment of the excellent work towards conservation of coal resources, now being done by the U. S. Bureau of Mines.—W.

BRIEFLY TOLD.

SIXTH MEETING, MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION.—"The sixth annual convention of the named Association was held in Joplin, Mo., April 11, 12 and 13. Headquarters were in the Connor Hotel, and the marked growth of the Association was well attested to when it is remarked that 200 were in attendance. The literary part of the proceedings, while prolific and worthy, both as to the number of papers read, and the usefulness of the various matters as presented and discussed, nevertheless for the greater number had no direct bearing on the gas industry. One of the number, however, even though it had no connection whatever with the artificial lighting trade, was that by Mr. Hugh Cooper, Hydraulic Engineer for the Mississippi Power Company, whose illustrated "talk" on the construction of the extension dam in course of building on the river, at Keokuk, Ia., was really the technical set prize. The executive conducting of the meeting was work well done. The social side of the sessions was diverting and enjoyable. Perhaps the leading features of this were: The trolley trip around and about the great zinc ore mines of the Joplin district (the Southwest Missouri Railway was the host on this occosion), the antics of the Rejuvenated Sons of Jove, and a most enjoyable banquet in the Connor. President Murray, it might be here said, is quite a wit, if we may judge of his reply to the address of welcome, besides many other odd indications which cropped out unexpectedly. The election for officers resulted in these namings, a look over which will regretfully show that Treasurer-Secretary N. J. Cunningham would not consent to a re-election:

President.—P. A. Bertrand, Joplin.
First Vice-President.—J. E. Marsh, Joplin.
Second Vice-President.—C. L. Clary, Sikeston.
Third Vice-President.—A. C. Einstein, St. Louis.
Secretary Treasurer.—P. W. Markham, Brookfield.

The meeting of the ensuing year will be held in Mexico, Mo. It will be noted that the leading genius of the St. Louis County Gas Company, was chosen an official.—F. H. G."

THE CLOSE OF THE PENNSYLVANIA MEETING.—Concluding our report of the proceedings of the fourth meeting of the Pennsylvania Association, the last "exercise" was commenced at 10 A.M. of the 12th inst. A soft drizzle greeted the members, but it in no wise dampened the ardor of the doings. The first thing to hand was the preliminary report from the "Publicity" Committee, and a thorough cleaning up of the "Short Topic" listings brought the technical sessions to an ending. That the men and the methods throughout the industry are undergoing change in the nature of development were forcibly brought out at this meeting. The majority of those active, as either officials or participants, have been giving the major portion of their thoughts and energy to the engineering part of the industry. Yet one may not blink the fact that the interesting discussions were pretty well all along the commercial lines. Perhaps, though, the reason for this is that for one engineer in the conduct of a works there are 20 engaged in the office division of the industry. Of course, this has no reference whatever to the part played by the appliance men in these gatherings. And that the latter are welcomed, does not admit of a doubt. The question of affiliation (after the clever outlining of the benefits thereof, as clearly enunciated by Secretary Ramsdell, of the Institute) was so enthusiastically settled in the affirmative that, whether there are doubters in the ranks of other State Associations respecting the good policy of this, such doubters are not in the Pennsylvania ranks.

SECOND MEETING, NEW JERSEY STATE GAS ASSOCIATION.—The second convention of the New Jersey State Gas Association will be held the 25th inst., in the Laurel House, Lakewood, N. J. The meeting will open at 11:45 A.M., at which time routine business, including the election of officers, will be disposed of. Luncheon is scheduled for 1:30, after which it is carded that addresses will be made by President W. H. Pettes, General Auditor of the Public Service Gas Company; Mr. E. C. Stokes, ex-Governor of New Jersey, and others. Trains leaving New York, via the New Jersey Central, at 10:20 A.M., will reach Lakewood in time for the sessions.

APRIL MEETING, GAS METERS.—The eighth meeting of the Gas Meeters will be held April 26th, at 4 P.M., at the Electrical Testing Laboratories, 80th street and East End avenue, New York. Inspection of laboratory, gas and electric lamps being tested for life, candle power, distribution and efficiency, Dinner, 6 P.M., Bismark Hall, 206 East 86th street; $2 per plate. Take Second avenue L to 80th street; walk three blocks east. H. THURSTON OWENS, Sec'y.

GAS PRESSURES, NEW YORK CITY.—The Public Service Commission, First District, New York, held the initial hearing respecting the gas pressure regulations, the afternoon of April 12th. The present hearing covers the Borough of Manhattan, and is based upon an investigation and report made for the Commission, by Mr. William A.

Baehr, who was unable to be present at the hearing, so that no business was transacted other than placing the report in evidence. The report represents a vast amount of work, conclusions being plainly stated and well amplified with charts, maps, etc. The next hearing is scheduled for April 26, at 2:30 P.M., in the rooms of the Commission, 154 Nassau street, New York city.

CURRENT MENTION—

MR. NORMAN MACBETH will resume his individual consulting illuminating engineering practice, having resigned as Illuminating Engineer for the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., and the Westinghouse Lamp Company, Bloomfield, N. J., where he recently organized an illuminating engineering department. It will likely be recalled that Mr. Macbeth previously organized a similar department for the Welsbach Company, Gloucester, N. J. As our readers are well aware, Mr. Macbeth has for some years been closely identified with the positively practical application of illuminating engineering. He proposes to give special attention to illumination development and publicity for central stations and gas companies, with particular reference to the education of salesmen, sales campaigns, and the handling of competition policies. He will maintain offices in the cities of Philadelphia and New York.

MR. FRANKLIN H. WENTWORTH, Secretary of the National Fire Protection Association, stated at the meeting of the New England Foundrymen Association (Boston, April 10) that, out of more than 1,100 fires under automatic sprinkler, of which the Association had records during the past 15 years, there was not a single instance where the automatic sprinkler, when of standard, approved make and installation, had failed to put out or hold in check a fire under it, save in cases where the system had been tampered with, or crippled by an explosion.

WE are indebted to the courtesy of Mr. Joseph M. Butler, Treasurer of the Corporation, for the information that the business of Mr. H. Koppers, by-product gas and coke oven constructor, at Joliet, Ills., has been taken over by the H. Koppers Company, duly incorporated under the laws of the State of Maine. The capital stock of the Company has been put at $500,000, all paid in cash. Its Directors are: Heinrich Koppers, Essen Ruhr, Germany; and J. C. McMath, Jos. M. Butler, W. E. Hartman and W. G. Wise, and its executive organization is as follows: President, Heinrich Koppers; Vice-President, J. C. McMath; Treasurer and Secretary, Joseph M. Butler; Managing Engineer, W. E. Hartman. The main offices of the Company will in the near future be removed to Chicago, and located in the Maller's Building, southeast corner of Madison street and Wabash avenue. Good luck to the reorganized concern.

MR. HENRY BULL, President of the Newport (R. I.) Gas Company, died suddenly, at his home in Newport, the night of April 17th. He was in his 70th year, and was a brother of the famous surgeon, the late Dr. William T. Bull. Another brother was the late ex-Congressman Bull. He is survived by his wife, a son (Dr. Tillinghast Bull, of New York), and a daughter.

To the Memory of Theodore R. Parker.

[Communicated by MR. E. C. JONES, Pacific Gas and Electric Co.]

Mr. T. R. Parker was a pioneer of the gas industry, beginning in the early fifties, when the business was in its infancy, and, by splendid manhood and vigorous mentality, he kept abreast of every advancement in his profession, weaving his best thoughts and fine mechanical skill into the cause, until he became inseparably a part of it. The gas business never had a truer friend nor more staunch supporter. His work and worth are recorded in substantial gas works construction, in the proceedings of gas associations, and are indelibly fixed in the hearts and minds of the many friends who loved him and profited by his teaching.

Born in New York City, October 21, 1838, he was educated in the public schools of that city. At the age of 17 he was employed as a full journeyman at the gasfitter's trade, and continued this work until 1859, when he received the appointment of Superintendent of the Exeter (N. H.) gas works, where he remained 3 years.

He came to California, by way of Panama, arriving in San Francisco, April 28, 1862, and in 1864 accepted the position of Superintendent of the Marysville gas works, 6 years after its incorporation; here he became associated with the late David E. Knight, and began the making of gas history. In February, 1869, he moved to a larger field of usefulness, in connection with the building and operation of the Napa gas works, where he remained for over 30 years. In addition to his duties as Superintendent of the Napa gas works, he held a similar position with the Napa City Water Company, from the date of its establishment until his death.

The organization of the Pacific Coast Gas Association, July 11, 1893, brought the gas men of the Coast together in close friendship, and T. R. Parker was a moving spirit and a charter member of the Association. At this time the coal gas works in Napa was equipped with the most modern type of full-depth regenerative benches, and the results obtained exceeded in excellence those of many of the best managed Eastern works. This was due to the skill and ingenuity of Mr. Parker, as he had applied his own improvements to the best knowledge then obtaining in the East, and his was the banner gas works in California. Coupled with mechanical excellence, was the highest degree of cleanliness possible in a gas works. The grounds surrounding the buildings were laid out in gardens of roses and cannas, while around the gasholder tank were beds of calla lilies, and at the back of the garden were trellises covered with purple wistaria. Everywhere, inside and outside the works, was evident the touch of Mr. Parker's knowledge of good taste. Such was the man who bent his energies to making a success of the newly organized Gas Association, and he breathed his spirit into it.

At the second meeting he became Wrinkle Editor and successfully carried on this work until 1896, when he was elected President of the Association. Meanwhile he served as a Director in 1895. He contributed several valuable papers to the Association's "Proceedings," and further enriched them with wise discussions. His devotion to his chosen work is expressed in the following words, taken from his Presidential Address, 1897:

"For all we have, as well as all that we are, is the result of labor and thought in the gas business."

The last paper contributed by Mr. Parker to the Association was entitled "Auld Lang Syne," which was read at the 12th Annual Meeting, July 19, 1904. The paper tells the life story of the different California gas companies and is of inestimable historical value.

The Pacific Coast Gas Association conferred upon Mr. Parker the greatest honor within its gift by unanimously electing him an Honorary Member, September 19, 1911.

His Masonic affiliations included life membership in Marysville Lodge No. 9, F. and A. M.; Napa Commandery, No. 34, Knights Templar (of which he was Recorder for several years), and life membership in Islam Temple, Nobles of the Mystic Shrine, of San Francisco.

Mr. Parker was married July 9th, 1862, at Exeter, N. H., and is survived by his widow, four sons and two daughters. His home life was ideal. Love dwelt in his house, and happiness abounded. No shadow crossed the pathway of these two dear people over a span which would have covered half a century had he been spared until next July.

The Rev. Richard Wylie, friend and spiritual adviser of Mr. Parker, pays this tribute to his memory in his funeral sermon:

"The statement will not be questioned or doubted by any who have watched the growth of our fair city during the past two score of years that, within that period, there has been no one of our citizens who has personally done more (if indeed as much), with brain and hand, as has done T. R. Parker, to secure the success of our public utilities; to develop those important systems of water, light and heating which are so essential to the health and happiness of the people of our city. With a clear and inspired judgment as to all questions of engineering, with a distinct genius for the solving of mechanical problems, he has toiled most intelligently and persistently to obtain for this community, in the realm of her public utilities, all that was possible and in keeping with the expert, practical wisdom of our times.

"While others have despaired, he has studied; while others have doubted, he has prayed; while others have slept, he has worked; while others have felt no special call to work for the public weal, he has discovered a heaven-given mission to accomplish for this city and community their permanent physical uplift and consequent moral and social betterment. To every home in Napa the benediction of his earnest life has descended to abide. Respected by all who knew him, deservedly honored in the assemblies of the most eminent scientific men of the State, beloved in the circle of his intimate friends, cherished in the home, where loving hearts of brave and devoted wife and dear and loyal children have ministered to him in the last sad scenes, he has now entered into the welcome rest that follows the life day of divine-like work."

Correspondence.

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Mr. Reichhelm's Points are Well Taken.

AMERICAN GAS FURNACE COMPANY,
24 John street, N. Y. City, April 17, 1912.

To the Editors, AMERICAN GAS LIGHT JOURNAL: The writer read with interest the article on "Industrial Gas Appliances," by Mr. H. L. Barnes, of Hartford, Conn., as printed on page 260 of your April 15th issue; but cannot help calling your attention to an error therein, as the same might be misleading.

The appliances illustrated and referred to in the said article were not manufactured by the Gas Company, and there is probably no need of our advising you as to who made the experiments and necessary tests to build appliances such as those referred to. We believe it would be more advisable, and not misleading, if the various representatives of gas companies or members thereof will not state that local gas companies have built the appliances, if they had not done so, but that these were built by manufacturers making a specialty of industrial fuel gas appliances, whose names they would give, if desired. Another correction I wish to make refers to the matter, on page 260, marked "Exhibit B." Mr. Barnes asserts that a cherry red heat is maintained in the retort, and that the toe calks passed through the entire length by gravity. This is not so. The work is conveyed continuously by the proper conveyor through the heated retort in the machine. It does not depend on the gravity, for as the machine is set up perfectly level, anyone can see that the gravity consideration does not enter into the operation whatever.

We hope you will be able to make this correction; and, thanking you in advance, beg to remain

Very truly yours,
AMERICAN GAS FURNACE CO.,
P. F. REICHHELM, Secy.

(*Continued from p. 271.*)

Where p = friction drop, pounds per square foot.
d = diameter of pipe in feet.
l = length of pipe in feet.
j = density of fluid, at the given pressure, pounds per cu. ft.
v = velocity of fluid, feet per second.
q = quantity of flow, at the given density, cu. ft. per second.
f = coefficient of friction, to be determined by experiment.

and $$C = \frac{\pi}{4}\sqrt{\frac{2g}{4f}} = 3.15\sqrt{\frac{1}{f}}.$$

Equations 10 to 12 represent the theoretical values of the pressure drop, velocity and quantity for the flow of a fluid through circular pipes. These equations, originally included under Chezy's formula:

$$f.\frac{v^2}{2g} = \frac{d}{4}\cdot\frac{h}{2}$$

Apply to any kind of a fluid with the use of the proper co-efficient of friction, and the proper units for the measurement of the quantities involved. Equation 13, however, is more general and can be used with any system of units, because the change from one system to another of a given unit makes a constant quantity, which can be included in the co-efficient of discharge, C, after the latter is determined experimentally.

(8.) Flow of Compressible Fluids.

The quantity or volume of a gas has very little meaning unless the pressure and temperature of the gas are given (or referred to standard conditions). The density of a gas is usually given as a per cent. of the density of atmospheric air, and not directly in pounds per cubic foot. In applying the hydraulic equations to compressible fluids, or gases, we have to consider the increase in volume, and consequently the increase in velocity and decrease in density caused by the expansion of the gas in the pipe during the continuous drop in pressure.

As far as the additional velocity drop is concerned, we can satisfy ourselves that it is negligible for all practical purposes by solving equation 6, even for extremely high velocities. But if we inspect equation 10,

$$p = 4f\frac{l}{d}\cdot\frac{v^2}{2g}j.$$

we see that the friction drop in pressure for a unit length increases with the square of the velocity and only with the first power of the density; and, therefore, the friction drop per length will by no means be constant through the whole length of the pipe for a compressible fluid. To illustrate this principle, suppose the line is made of such a length that the friction drop reduces the final absolute pressure to one-half of the initial.

From Boyle's law for constant temperature, the gas will expand during this change to double its volume. This will double the velocity at the end of the line and cut down its density to one-half. From the given equation, the effect of density will tend to decrease the drop per unit length to one-half, while the effect of velocity will tend to increase the same four times; as a result the actual drop per unit length will be twice as much at the end than at the beginning of the line.

As the increase in drop per unit length was caused by the decrease in absolute pressure in the same proportion, it follows that the drop per unit length at any point in the line will vary in the inverse proportion with the absolute pressure at this point. But since the absolute pressure is changing uniformly along the line, from P_1 at the beginning to P_2 at the end, therefore, we can say the total drop p of equation 10 will be the same as if the absolute pressure had an average value A with a corresponding velocity Va and a corresponding density Ja along the whole length of the line. Consequently, equation 10, and the following 11, 12 and 13, will hold true for a compressible fluid when all the quantities are referred to the average pressure in the line.

The same result would have been obtained from the solution of the equation by the methods of the infinitesimal calculus. As shown here, however, it has emphasized a very important point in the distribution of high pressure gas. Namely, that the drop of pressure for a given length is increased toward the receiving end of the line; and, therefore, the extension of a given line may require a larger size of pipe than the original part if the same allowance be made for the drop of pressure.

(9.) Application of Hydraulic Equations to the Flow of a Gas in Pipes.

Let P_1 be initial absolute pressure, pounds per square inch.
P_2 be final absolute pressure, pounds per square inch.

Let P drop of pressure $= (P_1 - P_2)$.
A average pressure in the pipe $= \frac{1}{2}(P_1 + P_2)$.
L length of pipe in yards.
D diameter of pipe in inches.
Q cubic feet of gas per hour reduced to standard conditions.
J density of air at atmospheric conditions = .0761.
W the density of gas to air as a unit.
Wj being the density of gas in pounds per cubic foot.
C the experimental co-efficient of discharge.

From equation 13 as referred to compressible fluids we have:

$$qa = C\sqrt{\frac{pd^5}{W\,Ja\,l}} \quad \ldots\ldots \quad \ldots.(14)$$

where $$C = 3.15\sqrt{\frac{1}{f}}$$

But $$q\ (\text{per sec.}) = \frac{Q}{3600}\ \text{per hr};\quad p = \frac{P}{144};$$

$$d = \frac{D}{12}\,l = 3L.$$

Therefore $$\frac{Qa}{3600} = C\sqrt{\frac{144\,PD^5}{WJa\ 3L.\ (12)^5}}$$

and $$Qa = 3600\,C\sqrt{\frac{144}{3\,12^5}}\sqrt{\frac{PD^5}{WJa\,L}} = 50\,C\sqrt{\frac{PD^5}{WJa\,L}}$$

or $$Qa = Ca\sqrt{\frac{PD^5}{WJa\,L}} \quad \ldots\ldots\ldots\ldots(15)$$

where $$Ca = 50\,C = 157.5\sqrt{\frac{1}{f}}$$

To change Qa and Ja to Q and J at atmospheric conditions. From Boyle's law of the relations of pressure, volume and density of a gas we have:

Q times atmospheric pressure = Qa times A
and J times A = Ja times atmospheric pressure.

Therefore $$Qa = \frac{14\,70}{A},\ \text{and}\ Ja = \frac{J\,A}{14.7}$$

Substitute the values of Qa and Ja in equation 15.

$$14.7\frac{Q}{A} = Ca\sqrt{\frac{\frac{PD^5}{WJ\,A.L}}{14.7}} = Ca\sqrt{\frac{14.7\,PD^5}{.0761\ WAL.}}$$

Therefore $$Q = \frac{Ca\,A}{14.7}\sqrt{\frac{14.7}{.0761}}\sqrt{\frac{PD^5}{WAL}} = Ca\sqrt{\frac{1}{14.7\times.0761}}\sqrt{\frac{PAD^5}{WL}}$$

$$= .946\,Ca\sqrt{\frac{PAD^5}{WL}} = C_1\sqrt{\frac{PAD^5}{WL}} \quad \ldots\ldots\ldots\ldots(16)$$

where $$C_1 = 0.946\,Ca = 149\sqrt{\frac{1}{f}}$$

If in equation 16 we substitute $(P_1 - P_2)$ for P and $\frac{1}{2}(P_1 + P_2)$ for A. the form is changed to:

$$Q = C_1\sqrt{\frac{(P_1 - P_2)\,\frac{1}{2}(P_1 + P_2)\,D^5}{WL}} = \sqrt{\frac{1}{2}}\,C_1\sqrt{\frac{(P_1^2 - P_2^2)\,D^5}{WL}}$$

$$C_2\sqrt{\frac{(P_1^2 - P_2^2)\,D^5}{WL}} \quad \ldots\ldots\ldots\ldots(17)$$

where $$C_2 = \sqrt{\frac{1}{2}}\,C_1 = 105.5\sqrt{\frac{1}{f}}$$

(It will be shown later that equation 17 is identical with Unwin's formula for high pressure gas.)

When the pressure of gas is nearly atmospheric, the drop of pressure in the pipe is usually given in inches of water. Calling the pressure atmospheric (the difference being negligible) and putting A = 14.7 in equation (16) we have:

$$Q = C_1\sqrt{\frac{14.7\,PD^5}{WL}} \quad \ldots\ldots\ldots\ldots(18)$$

Let H be the drop of pressure in inches of water:

then $$H = 27.7\,P \qquad P = \frac{H}{27\ 7}$$

therefore $$Q = C_1\sqrt{\frac{\frac{14.7}{27\ 7}HD^5}{WL}} = C_1\sqrt{\frac{14.7}{27.7}}\sqrt{\frac{HD^5}{WL}}$$

$$= 0.73\,C_1\sqrt{\frac{HD^5}{WL}} = C_2\sqrt{\frac{HD^5}{WL}} \quad \ldots\ldots\ldots\ldots(19)$$

where

$$C_2 = 0.73\, C_1 = 109\sqrt{\frac{1}{f}}.$$

(10.) DR. POLE'S FORMULA.

If we let f the co-efficient of friction take the constant value of .006, then C_2 in equation (19) becomes 1410 for 60°, or 1350 for 32° F. and we have the time honored Dr. Pole's formula.

$$Q = 1.350\sqrt{\frac{HD^5}{WL}}$$

which was really a solution of Chezy's hydraulic formula for the given units and constant co-efficient of friction.

Mollesworth uses the same equation with C = 1000, instead of 1350. Hawksley puts C = 1290. We may find more values for C if we should look for them.

(11.) VARIATION OF COEFFICIENT.

As far back as 1857, Darcey, experimenting on the flow of water in the Paris water mains, and applying Chezy's formula to the results, found that the formula could be used only with a variable coefficient of friction. According to Darcey's experiments the coefficient of friction was shown to vary: 1, With the velocity of the flow; 2, with the diameter of the pipe; 3, with the roughness of the rubbing surface. Disregarding the dependence upon the velocity, Darcey proposed an expression for the coefficient to be

$$f = a\left(1 + \frac{b}{d}\right)$$

Where f is the coefficient of friction and a and b are quantities depending upon the roughness of the rubbing surface. Eitelwein would rather neglect the dependence of the coefficient upon the diameter, proposing the expression:

$$f = a\left(1 + \frac{b}{V}\right)$$

V being the velocity of the flow. Welsbach proposes the form:

$$f = a\left(1 + \sqrt{\frac{b}{V}}\right)$$

Fanning computed, and arranged in an extensive table, numerical values for f, taking both diameter and velocity into consideration. Thus, the hydraulic engineers had, more than half a century ago, formulated expressions for the variation of the coefficient of friction in the flow of water in pipes. The gas people, however, continued for a long time to use Dr. Pole's formula as a standard with one constant for all pipes and velocities.

(12.) UNWIN'S LECTURE ON GAS DISTRIBUTION.

It was only in 1904, when the question of a variable coefficient for gas formulae was first brought up by Prof. Unwin, in a lecture before the Institute of Gas Engineers, in London. In this lecture (published in *Journal of Gas Lighting*, June, 1904), Prof. Unwin, discussing the variation of the coefficient in various circumstances, says that he applied successfully Darcey's form: $f = a\left(1 + \frac{b}{d}\right)$ to experimental data of tests on compressed air, and deduced the numerical values to be $f = .0027\left(1 + \frac{3}{10d}\right)$. For gas pipes, usually having a larger degree of roughness, Unwin states the numerical values will probably be:

$$f = 0.0041\left(1 + \frac{1}{7d}\right)$$

As Prof. Unwin left this coefficient detached from the formula it was hardly ever used in connection with low pressure gas; we can, however, substitute the value of this coefficient into the form of equation 19:

$$Q = 109\sqrt{\frac{1}{F}}\cdot\sqrt{\frac{HD^5}{WL}}$$

Taking D in inches we have:

$$Q = 109\sqrt{\frac{1}{0.0041\left(1 + \frac{12}{7D}\right)}}\cdot\sqrt{\frac{HD^5}{WL}}$$

$$= 1{,}700\sqrt{\frac{HD^5}{WL\left(1 + \frac{12}{7D}\right)}} \quad \ldots\ldots\ldots (20)$$

Which would be the proper equation with Unwin's coefficient for the low pressure gas.

(13.) UNWIN'S EQUATION.

The equation for high pr essure gas distribution given by Unwin:

$$U_1 = 468\sqrt{\frac{d}{fWl}\left(\frac{R^2 - P_2^2}{P_1^2}\right)}$$

Where U_1 = velocity of gas feet per second pressure P_1;
d = diameter of pipe in feet;
P_1 = initial pressure pounds per square inch absolute;
P_2 = final pressure pounds per square inch absolute;
W = density of gas, air = 1;
l = length in feet;

$$f = \text{coefficient of friction} = .0041\left(1 + \frac{1}{7d}\right)$$

To put this in a convenient form for figuring the quantity at standard conditions, we have:

$$q_1 = \frac{\pi}{4}d^2 \cdot u_1 \text{ in cu. ft. per sec. at pressure } P_1.$$

But

$$q_1 = \frac{Q}{3600}\cdot\frac{14.7}{P_1};\quad d = \frac{D}{12};\quad l = 3L$$

Then

$$\frac{Q}{3600}\cdot\frac{14.7}{P_1} = \frac{\pi}{4}\cdot\frac{D^2}{144}\cdot 468\sqrt{\frac{D}{12}\cdot\frac{1}{fw.3L}\cdot\frac{(P_1^2 - P_2^2)}{P_1^2}}$$

Therefore,

$$Q = \frac{3600\,\pi}{14.7\times 4}\cdot\frac{468}{144}\cdot\frac{1}{6}\cdot\sqrt{\frac{1}{f}}\sqrt{\frac{(P_1^2 - P_2^2)\ D^5}{WL}}$$

$$= 104\sqrt{\frac{1}{f}}\sqrt{\frac{(P_1^2 - P_2^2)\ D^5}{WL}} \quad \ldots\ldots\ldots (21)$$

which is identical with equation (17)

Note.—Unwin figured the velocity at 50° F., hence the small difference of 104 (instead of 105.5).

Substitute Unwin's value of f into equation (21).

Therefore,

$$Q = 104\sqrt{\frac{1}{.0041\left(1 + \frac{12}{7D}\right)}}\sqrt{\frac{(P_1^2 - P_2^2)\ D^5}{WL}}$$

$$= 1625\sqrt{\frac{(P_1^2 - P_2^2)\ D^5}{WL}} \quad \ldots\ldots\ldots (22)$$

which is a convenient form deduced from Unwin's equation for high pressure gas.

(14.) CONSIDERATION FOR INTERNAL FRICTION.

It appeared to the writer that the effect of internal friction or the viscosity of the fluid, which was neglected in the consideration of the mean hydraulic radius, must have some bearing upon the variation of the co-efficient with the size of the pipe. The resistance to the flow caused by internal friction stands in proportion with the area, while the skin friction varies with the perimeter of the flow; and, therefore, it is highly probable that, when the size of the pipe increases over a certain limit, the internal friction will become so noticeable that the co-efficient, instead of diminishing, wi.l increase with the diameter of the pipe. This consideration led to the adoption of the form

$$t = a\left(1 + \frac{b}{D} + cD\right) \quad \ldots\ldots\ldots (23)$$

which takes care of variation in both directions.

With reference to some of the data given later the numerical values of 3.6 and 0.03 were deduced for b and c respectively. With these numbers in equation 23, f has its minimum value for a 12-inch diameter. Using Unwin's co-efficient for this diameter, we have

$$f = 0.0041\left(1 + \frac{12}{7\times 12}\right) = a\left(1 + \frac{3.6}{12} + 0.03\times 12\right)$$

Therefore,

$$a = \frac{0.0041\times 1.143}{1.66} = 0.00283$$

and

$$f = 0.00283\left(1 + \frac{3.6}{D} + .03D\right) \quad \ldots\ldots\ldots (24)$$

Substitute the value of f into the form of equation 16

$$Q = 149\sqrt{\frac{1}{0.00283}}\sqrt{\frac{PAD^5}{WL\left(1 + \frac{3.6}{D} + .03D\right)}}$$

$$= 2800\sqrt{\frac{PAD^5}{WL\left(1 + \frac{3.6}{D} + .03D\right)}} \quad \ldots\ldots\ldots (25)$$

or if we take the length in miles, then

L yards = 1,760 L miles.

$$Q = \frac{2800}{\sqrt{1760}}\sqrt{\frac{PAD^5}{WL\left(1 + \frac{3.6}{D} + .03D\right)}}$$

$$= 66.5 \sqrt{\frac{PAD^5}{WL\left(1 + \frac{3.6}{D} + .03D\right)}} \quad \ldots\ldots\ldots (26)$$

Equation 19 for low pressure becomes:

$$Q = 109 \sqrt{\frac{1}{.00283}} \sqrt{\frac{HD^5}{WL\left(1 + \frac{3.6}{D} + .03D\right)}}$$

$$= 2050 \sqrt{\frac{HD^5}{WL\left(1 + \frac{3.6}{D} + .03D\right)}} \quad \ldots\ldots\ldots (27)$$

(16.) Tests of the Peoples Gas Light and Coke Company.

The engineering department of the Peoples Gas Light and Coke Company, of Chicago, performed a number of experiments upon pipes of various sizes, either in actual service, or made up similar to those in actual service. Extensive tests were performed upon the smaller sizes to determine the capacity of low pressure house service pipes. The results of these tests tend to show that for the same size of pipe the square root of the friction drop includes a constant amount after the subtraction of which the remainder varies in direct proportion with the quantity of gas discharged through the pipe. At small velocities of the gas this constant forms a large percentage of the total, making the discharge apparently vary as the drop and not as the square root of the drop in pressure. At larger velocities the constant has very little significance and the theoretical proportion holds fairly true in those cases.

(17.) Possibility of Initial Drop of Pressure.

We have met before with the expressions of Eitelwein and Welsbach for the coefficient of friction, indicating also that the drop of pressure is proportionally larger at low velocities. It will be more convenient, however, to explain this relation in a different way. It is possible that a small amount of pressure is necessary in each case to overcome some initial resistance in the pipe similar to what is called in mechanics friction of rest. This amount, which may be constant for each size of pipe, will necessarily be more noticeable for small velocities and short lengths, but when this is properly subtracted, or allowed for, the proportionality may remain the same in all cases. It is highly probable that this is actually the case from the fact that the friction drop is of the same nature as the velocity drop, both coming from the same cause, the velocity of the gas, and, therefore, the two shall vary in the same proportion, following the square of the velocity in the pipe.

As far as the proper size of street mains is concerned this initial drop may be entirely neglected, because the mains are usually figured for considerable length and some reasonable flow of gas where this drop becomes insignificant. In the case of service pipes which were covered by the tests of the company, the initial drop was taken care of in the proper equation for the given size.

The tests performed upon the larger sizes included 24 and 36-inch low pressure, and 10, 16 and 24-inch high pressure mains. It could not be arranged for the present to run tests on any other sizes, but as the data included a large range of diameters it will be used to compare the given formulæ and check the co-efficient.

(To be Continued.)

Credits.

[Prepared for the Fourth Annual Meeting, Pennsylvania Gas Association, by Mr. Wm. Hoffman, Reading, Pa.]

What is credit? The term "credit" is derived from the Latin word *credo* (I believe), and its opposite word, "debt," from *debeo* (I owe); and there can be no debt without credit, and no credit without debt. The word implies the belief of one of the parties to a transaction in a promise made by the other, and an obligation acknowledged by one party as due to the other.

The Century Dictionary defines credit as "Trust; confidence reposed in the ability and intention of a purchaser (of merchandise) to make payments at some future time, either specified or indefinite."

Someone has said: "Credit is to business what mortar is to a wall; it is the adhesive material with which commerce is cemented." For the majority of our sales we deliver our goods, not for money paid down, but for promises to pay money at some future day.

The humblest citizen, as well as the greatest manufacturer, feels the power and recognizes the influence of credit. Credit enters into the life of every business man in this country. The rapid development of the gas companies we represent is largely due to the liberality with which for many years crdit has been granted, furnishing the bold, aggressive business men with means to accomplish results which otherwise they could not have reached.

Credit is indispensable; it advances the prosperity of our companies, and insures progress so long as it is given judiciously and wisely. On the other hand, if it be extended to persons who are unworthy, or who become embarassed because of lack of character, ability or honesty, the result is extremely detrimental. Someone has truly said that credit never knocks at the door of the indolent, never lingers under the shadow of indecision, never smiles on good intentions that are barren of results.

Credit often times becomes too cheap and is too readily obtained. As time goes on, the margin of profit in all lines of business seems to be constantly narrowing, and to extend credit properly and safely requires the highest exercise of mental power, and often times the credit man is called upon to make investigations which are both delicate and intricate in their nature.

In considering the responsibility of a borrower, a number of things must be taken into consideration. What are his habits? Is he extravagant? Does he live beyond his means? Is he spending more money than he earns? And, "Has he a reputation for honesty?"

In investigating the honesty of an applicant for credit, it is always better to find out, in an indirect way, his idea of what constitutes honesty. There are, generally speaking, two classes of people who ask for credit, and do not make their payments as per agreement; they are the ones who will not tell you anything at all about themselves, and those who will tell all anybody wants to know, and considerable more besides. A credit man should beware of both under ordinary circumstances. Many credit men make bad extensions of credit because they do not pay enough attention to little things; in other words, they do not appreciate the force of the saying that, "straws indicate the way the wind blows."

There is no good reason why parties who are guilty of making fraudulent purchases should not be punished to the fullest extent, for there is little difference, if any, between a man who robs you of your purse and one who, by a successful constructed network of falsehoods, has obtained money or its equivalent in merchandise from you. It is not a question how much goods can be sold, but what volume of business can be transacted with only minimum losses from bad debts, and how sales can be increased each year, with a decrease in the percentage of loss. This is a subject that interests us all, for when the year closes and we make up our figures, we are naturally very anxious to exhibit a satisfactory record. A safe prospective credit can not be rigidly fixed to cope with every individual instance. The successful credit man must always take this into consideration. Credit is the cause of most business losses, but it is also the cause of most great business successes.

The problem of credit management, therefore, consists in the endeavor to reduce the former and to increase the latter. For the sake of the one, credit is discouraged; for the sake of the other, it is encouraged.

The credit department may be called the hub of the business, inasmuch as around it circulate many of the activities of the office—selling, accounting, correspondence, and every other function connected with the distribution of goods. It is at once an outlet for the extension of business and a check upon doubtful accounts. If well managed it may foster trade, and if badly conducted it may seriously hamper the efficiency of the sales department.

The credit man's position is one of such great importance and responsibility that, in my estimation, he should be at the head of all the office work. He should control the collections and oversee the accounting department in addition to his immediate work as chief of his own department. His province is to reach conclusions about men through personal relations with them, and by the study of records and reports. His success may be measured by the average annual losses. His duties are more complex than those of any other individual in active management, because they embrace a part of every side of the business. He must be bold as well as cautious, and must take the same care to increase sales as to make them secure; to attract prospective customers as to retain present ones. And where he thinks it unsafe to grant credit, he must try to retain the customer's goodwill and trade by the use of other methods.

The duties of a credit man are of a very delicate nature, because it touches a man at his most sensitive point; it concerns his property, character and financial ability. It is one thing to have a good record

as a credit man for refusing orders, and another to have a low percentage of loss upon large sales. Naturally, the most successful credit man is the one who has the fewest losses and can retain the goodwill of the public. The weak credit man is destructive; the strong credit man constructive. Failures and strikes in certain sections of our cities will affect the situation of many of our consumers, and he must have such facts in his head when he is judging credits.

The credit man will understand that his is both to prevent and to remedy; to prevent accounts from being entered which will be difficult or impossible to collect; and to remedy, by collecting, or doing everything possible to collect, accounts that have been entered. No two consumers can be treated alike. And this fact makes it advisable for the credit man to have imagination and originality. The very responsibility of the credit man's position makes it necessary for him to avoid all routine work himself; he must delegate all other work that he can to his subordinates, so that whenever it becomes necessary he can look after collections which are beyond the ability of the collectors.

A condition existing in a great many of our companies is that a mutual hostility exists between the credit and sales departments. When a sales department is working under a point system, their motto usually is, "Sales at any cost, and do not consider losses." If the interest of the company would always be considered, these departments would and should always work in harmony to prevent losses. In order to have proper co-operation they should consult together as often as possible.

The solicitor or salesman in the sale of appliances, etc., should endeavor, in every instance where a sale is contemplated, or about to be consummated, to learn as much as possible about the credit (or ability to pay) on the part of his prospective purchaser. He should endeavor (in an indirect way) to ascertain whether he is owner or lessee of the premises occupied; if lessee, the length of his lease. This information will be of great assistance to the credit man; it saves time and gets the orders into the distribution department without much delay.

It is the earnest desire of all our companies to increase the sale of their product; for this reason solicitors are employed and looked to for the greater part of this increase. He should, however, have in mind at all times, that the goods he sells represent large investments of moneys on the part of the company, and that the goods sold are expected to be paid for promptly, according to the terms of sale.

Generally speaking, gas companies are very liberal in extending credit, which is undoubtedly a great help to solicitors in making sales. For this reason every effort should be put forth by them to obtain a first payment on all sales made. If a first payment is secured, at the time an order is taken, all back calls on the part of the solicitor will be avoided, and the offenses usually taken on the part of purchasers, when they feel their credit is being questioned, will be obliterated. It may possibly be of some interest to acquaint you with the methods used by our Company in extending credit. Previous to January 1, 1912, all persons who paid their gas bills regularly were given credit for any amount, from 5 cents to $5, without question. Since above date we have established a rule whereby all goods sold for $1 or less must be paid in cash. We have increased our cash sales three-fold, we have eliminated a large amount of bookkeeping, and through it we believe we will be able to dispense with the services of one of our collectors in the near future. It was surprising how nicely our customers fell in line when we explained to them, that we were not questioning their credit, merely trying to avoid bookkeeping the same as any other large concern doing business.

On sales of from $5 to $12, $1 is collected when sale is made and $1 per month required. For any amount above $12 we have a contract which is signed by the purchaser, in which he agrees to pay $\frac{1}{12}$ of the purchase price when sale is made, or upon installation, and the balance in monthly payments, the time not extending over 1 year. Whether it be property owner or lessee, each is treated with the same amount of consideration. When a lessee pays his rent and store bills promptly, we consider him a good risk, and extend credit to the amount of $25.

Our fitters are working under the same instructions as those laid down to the sales's people; if an agreement card is made up for any additional work, he explains the company's rules to them, and if the amount is under $1, it is a cash consideration and he must collect the money, or he cannot do the work. Telephone orders are treated the same as above. In this case a bill accompanies the order and the fitter makes the collection; in the former case a receipt is mailed. If a stranger applies for gas and gives us the name of a consumer for reference, the application is given to a collector, who in turn calls on the consumer, and if he assumes the obligation, a meter is installed without further questions and our Company holds the party signing the application responsible for all unpaid bills. In conclusion, I should like to ask if any of the companies represented here, as a last resort, remove meters when all other methods fail to collect sundry accounts?

National Bureau of Standards, Circular on Illuminating Gas Regulations.

The Department of Commerce and Labor, Bureau of Standards, Washington, D. C., informs us that the National Bureau of Standards is about to issue a circular, entitled "State and Municipal Regulations for the Quality, Distribution and Testing of Illuminating Gas." This circular (133 pages, uniform in style with other Bureau circulars) has been prepared after conference and correspondence with a large number of gas engineers and inspectors; and it is claimed to represent, as nearly as possible, the average opinion of many men active in the field of gas manufacture and gas testing.

Part I. of the circular gives a summary of the municipal gas ordinances now operative, presents a general discussion of municipal gas requirements, and proposes an ordinance largely compiled from the best ordinance requirements now in force.

Part II. treats similarly of State control of gas companies, and proposes technical rules for State regulations.

Part III. quotes a few ordinances typical of those recently enacted, and gives the main portions of State gas laws now in force affecting gas quality, pressure and meter accuracy.

The circular does not concern itself with financial regulation of gas companies, nor does it include any discussion of the comparative value of various methods of works' management. It deals mainly with the candle power, heating value, purity and pressure of the gas, and gas meter testing.

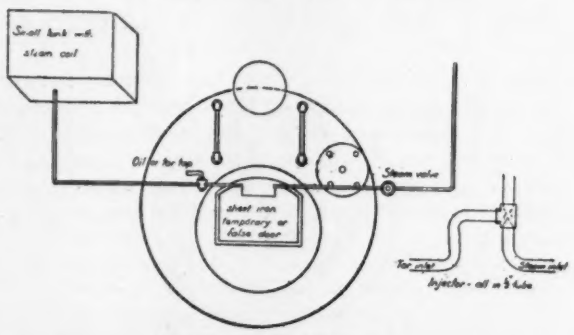
The present publication has grown out of the investigation of the methods and standards employed in gas photometry and gas calorimetry, undertaken by the Bureau 3 years ago. A second circular on the methods of testing employed for official inspection work is now being prepared. Althongh it cannot be expected that the regulations for or methods of gas testing will for many a day be entirely uniform throughout the country, it is thought that, if the results of a comprehensive investigation of the subject are published, a greater uniformity of method, and in some cases more accurate measurements, will result.

The attitude of the Bureau of Standards in this matter is entirely advisory, and its intention is to place in the hands of the technical and general public an impartial and, as nearly as may be, an accurate summary of the facts which must be considered in connection with the fixing of standards of quality and the testing of illuminating gas.

Revision of the circular from time-to-time is contemplated in order to amend the recommendations as to the requirements to adapt it to new developments in the gas industry. The circular is ready for distribution, and copies may be obtained free of charge by addressing The Director, Bureau of Standards, Washington, D. C.

Tar Firing for Boilers.

Mr. John J. Henshall, of Mount Pleasant, Welmslow, Cheshire (England), recently sent to the *Gas World* the sketch given herewith of a plan for a tar or oil burning device, affixed to and in a boiler,



Steam Raising with Tar.

which is simplicity itself, and which he asserts he is using (and has been using) for some years with success. The sketch is really sufficient to describe the system without further explanatory matter, save to say that the apparatus can be made and placed in a few hours, and that any steam pressure over 30 pounds can be maintained with it. Again, breeze or any other combustible rubbish may be thrown on the fire bars of the boiler furnace.

Management & Commercial Methods.

A MODEL GAS APARTMENT. BY MR. J. E. PHILBRICK, YORK (PA.) GAS COMPANY.—With the idea in mind of having a proper demonstration of appliances and fixtures, and also appreciating how difficult it is to get people to go to a basement room, we remodeled our down stairs throughout, and the rear (which we had previously used as an old stock room) we utilized as one demonstrative room.

The general display and reception room is immediately in front of the apartment, and everyone visiting the apartment must see our display of fixtures and appliances. The architecture is colonial throughout and is finished in white enamel, having a very clean and inviting appearance. The windows have the sash and curtains, but no glass, leaving plenty of opening for ventilation. The hall leading to the various rooms is artistically papered and trimmed, and every detail is brought out by suitable lights.

The library, to the right, with a portable gas lamp, and a well filled bookcase, chair, etc., invites the lookerson to tarry.

A Model Gas Show Apartment.

The drawing room opposite, with its walls of hand painted forest scenery, in light blue and white enamelled wood work, mahogany shelf and glass doors, are all in keeping with the other surroundings. The kitchen is equipped with all modern appliances, a large kitchen cabinet, a cabinet gas range, circulating hot water heater, and mantle light.

The latter, as a local paper quotes, "Is so unsurpassed as to allure even a Knight of the Road." Its wall of hand painted dutch scenery, tile sides and floor and white enamel wood work are all examples of modern sanitary methods. An instantaneous heater in the room proper and an automatic in a separate room is connected to the lavatory, and tube supplying hot water.

In introducing the room to the public we advertised this extensively, and gave every one visiting the rooms a chance on a gas range, lamp, or small device, and were successful in having the rooms almost crowded for the space of 3 or 4 weeks. This incident showed a marked increase in the sale of appliances and fixtures.

Items of Interest
FROM VARIOUS LOCALITIES.

THE proprietors of the Galveston (Tex.) Gas Company have authorized the Gas Machinery Company, of Cleveland, O., to add to the existing plant a set (complete) of water gas apparatus, in order that the largely increased demand for gas in the Gulf City may be properly taken care of. The contract, besides the set, specifies the necessary purifiers, exhauster, tar extractor, etc., required to completely answer the requirements.

THE Baltimore *Sun*, of the 7th inst., carries a ½-page illustrated story showing the first building duly lighted by gas in that city, a complete line reproduction of the Company's Spring Garden plant, and a copy of a bill rendered to Mr. A. Weiskettle, of 68 Washington street, for gas used between the dates of June 1, 1870, and July 1, 1870. The quantity was 800 cubic feet, the gross rate was $3.30, and the rebate was one-eleventh, which was allowed on all bills settled before the 20th of the month in which the same were rendered. We wonder if this Mr. Weiskettle was any relative of the founder of the great kitchen range manufacturers, whose Fire King goods—both coal and gas—are known the world over. The text of the Baltimore Company's "ad." brings the total space occupied by it up to the space above noted.

MR. C. N. JELLIFFE, Secretary of the American Light and Traction Company, has been chosen Treasurer. He succeeds Mr. J. N. McCarthy in the dual position, Mr. McCarthy having retired from active business. Mr. F. O. Brown was elected to the Board of Directors, vice Mr. W. L. Bull.

"V. V. W." writes: "Mr. John C. Knight, formerly General Manager of the Peoples Gas and Electric Company, of Oswego, N.Y., died at his home in that city the morning of April 1st. His death greatly shocked the residents of that place, for although Mr. Knight had been complaining of a cold for a week or so, he nevertheless was able to make up the men's payroll for March 30. His physician diagnosed the trouble as heart disease. Deceased was born in Montour Falls, near Elmira, N. Y., in 1866. His first business connection was with the General Electric Company, of Schenectady, N. Y., and while there employed he invented an arc lamp that found considerable favor. In 1897 the affairs of the Peoples Gas and Electric Company were in very bad shape, but when he left the Company 10 years later, order had been restored, and from being an especially objectionable concern, his tact and resourcefulness were such as to have that unpleasant holding turned into one almost of esteem. Returning to Oswego, he organized the Citizens Lighting Company, which ultimately came into the control of the Peoples Gas and Electric Company. This did not add anything to the way in which deceased was regarded in the community, although he was Vice-President of the amalgamated concern for a year, which position carried with it the management of the corporation. That year, however, saw his withdrawal from its affairs and his engaging in the manufacture of cigars. He was always prominent in the social and fraternal life of this vicinity, and is survived by Mrs. Knight and a daughter. Other next of kin are two sisters and a brother."

THE gas rate in Stamford, Conn., since the 1st inst., has ruled at $1.20 per 1,000 cubic feet, a concession of 10 cents, The electric schedule was also readjusted. Formerly the kilowatt rate was 13 cents; it is now 12 cents.

RECENTLY there was an auction sale of the effects in the house of a retired sea captain, whose home for many years had been in Stapleton, Staten Island, and Mr. W. J. Welsh, the managing man of the New York and Richmond Gas Company, attended the sale. Naturally, the effects included several marine views, and two of these, respectively, "Clipper Ship Dreadnaught, off Tuskar Light," and "Hove to for a Pilot," fell to the bid of Mr. Welsh. The object of his purchase was nicely shown later when he presented them to Governor Newberry, the Managing Director of the Home for Seamen, known to almost everyone in its beautiful Staten Island location under the title of "Sailors' Snug Harbor."

A DECREE for the dissolution of the Providence (R. I.) Gas Burner Company was recently entered in the Superior Court, on the petition of Mr. Thomas L. Walker.

THE Cruse-Kemper Company has been authorized to construct a gasholder for the Portsmouth (Va.) Gas Company, up to retaining 300,000 cubic feet. Another contract recently awarded the same firm was by the Newport News and Old Point (Va.) Railway and Electric Company, for a holder up to retaining 250,000 cubic feet.

MR. JNO. C. D. CLARK, new Manager of the Utah Gas and Coke Company, of Salt Lake City, on taking hold of the business handle, said this to a reporter of the Salt Lake *Tribune*, responding to the query as to what he proposed to do in the instance of making new rules and changes in the way of doing things: "I am not an importer of labor and expect to make no changes in the force of men here. The only change to be made will be in the system of accounts,

and Mr. Smith will merely make that uniform to the system used in our other plants. The plant in Salt Lake City is the largest of 9 owned by our Company, and this is our second venture West. The plant at Boise City was taken over by our Company, February 1, 1912."

"W. W. M.," writing from Lafayette, Ind., under date of the 9th inst., incloses this mention: "Mr. Henry A. Buckweg died at his home the morning of Saturday, the 6th inst., after an illness that lasted several months. He was born in Lafayette, June 19, 1856, and was educated at Notre Dame University. His first business experience was with the Taylor Coal Company, as bookkeeper, and afterwards became bookkeeper for the Lafayette Gas Company. When that corporation was taken over by or became a member of the Indiana Lighting Company, Mr. Buckweg was appointed Travelling Auditor, which position he held until illness obliged him to retire from active life. The funeral services were held in the church of St. Boniface, the morning of the 9th inst., and interment was made in St. Joseph's Cemetery. He is survived by a son and 5 daughters."

On the 5th inst. the Sprague Meter Company made a shipment of 1,800 meters to a large South American seaport.

The Augusta (Ga.) Gas Light Company is now owned by a syndicate of Baltimore and Washington capitalists. Its officers are: President, Mr. J. M. J. Lewis, Baltimore; Vice-President, Dwight F. Mallory, Baltimore; Secretary, F. R. Neller, Washington. The plant will be virtually reconstructed, and these contracts have been placed: One 8-foot water gas set, complete, to the U. G. I. Company, and an up-to date boiler plant.

Mr. J. C. O'Gorman, of the office force of the Brooklyn Union Gas Company, died at his home in Brooklyn, the morning of the 6th inst. He was in his 29th year, having been born in Brooklyn, August 25, 1883.

Not long ago we had occasion to mention, in outlining the plan of pensioning put forth by the Baltimore Consolidated Gas, Electric Light and Power Company, that the oldest man on the list, both as to years and time of service with the Company and its predecessors, was Wm. H. Boesche. His age was 70, and his service covered the time space of 56 years. Now we are obliged to report his death, which happened the night of the 10th inst. The funeral services were held in his home, 1425 Clarkson street, the afternoon of the 13th inst. He is survived by his widow, four sons and one daughter. Although this humble man was a blacksmith, nevertheless his services to the Company along such uneventful lines, over the tracks of which scarcely anything other than drudgery passed, it is, notwithstanding it all, the fact that his ways were such as to compel the respect of his fellows, and to attract the attention of his superiors.

"W. M. T.," writing from Syracuse, N. Y., under date of the 12th inst., incloses the following: "This week the electrical contractors, 'and allied forces,' met in the palm room of the Osborne House, Auburn, N. Y., and dined with the representatives of the Empire Gas and Electric Company, which well-managed concern performs satisfactorily all the public and private lighting of beautiful Auburn. It is needless to say that the joint meeting was a social success and of technical worth as well. Mr. Henry L. Coleman, General Manager of the corporation, was the presiding genius, and he presided well, and in his well arranged, nicely delivered series of reasons for the assembling, he hit it off exactly when he declared it was simply a 'getting acquainted gathering,' for the purpose of talking over informally about matters of interest to all contractors who may come in contact with Mr. A. E. Hibner (Manager of the Company's commercial division) and Mr. L. C. Reynolds, Superintendent of its electrical division. Both of the named gentlemen were present, and each contributed much to the interest of the process of 'acquainting.' By-the-way, it is my pleasant task to conclude this recital by remarking that 'Harry' Coleman has the good will of every resident of this city—quite like that formerly the portion of that prince of gas men, David M. Dunning—whose grapes grow greater than those of any other grower in this most delightful of valleys."

The Taiwan (Formosa) Gas Company has been organized by local capitalists, and proposes to construct and operate, in the city of Taiwan, a gas plant, a franchise for which, to run 28 years, was granted by the authorities of the province. Taiwan is the second largest city in the named island.

Attorney Guernsey, representing the Des Moines (Ia.) Gas Company, declares that it will not submit to the ruling of Master-in-Chancery Sloan that 90 cents is a proper selling rate for gas in Des Moines. This action, of course, is taken in light of the knowledge that the decision of the case of Cedar Rapids, along similar lines, as per Supreme Court of U. S. decree, was adverse to the Company. It is held that the dissimilarity of the underlying point at issue is sufficient to warrant the appeal.

A certificate of organization has been filed at Portland, Me., declaring the organization of the Denmark (Me.) Lighting Company, to manufacture and distribute gas and electric currents in the adjoining Maine settlements of Denmark, Sebago, Brownfield and Naples. The President of the corporation is Mr. W. E. Sanborn, of Sanford, Me., and its Secretary is Mr. Merrill J. Lord, of Parsonsfield, Me.

Mr T. J. Jones, General Manager of the El Paso (Tex.) Gas and Electric Company, will have a very busy spring and summer of it. The demand for gas has gone ahead so rapidly the past 3 years that the works will have to be extended almost to the point of complete reconstruction. To meet the conditions, at a special meeting of the proprietors held last month, it was determined to do these things: The purchase of the plot (known as the Stevens-White tract) on the river just west of the Watts' water plant, was ratified, and on this plot a holder, up to retaining 500,000 cubic feet, is to be erected; a complete new scrubbing and condensing apparatus will be installed; a station meter, to be in separate house, is bargained for; and a suitable office for the engineering force of the works will be constructed. To close the recital, the main system will be added to materially, the most notable instance in this connection being an extension to Orchard Park, East El Paso. Well, it is safe to here remark that Major Gordon, of Chesapeake & Ohio Gas Coal Company fame, when he proposed to Mr. Jay Gould that they should construct a gas plant in El Paso, which proposition was made in the early eighties, not even in his most enthusiastic mood over the future of Texas, fancied that within 15 years time the gas supply of "Paso City" would require a holder up to retaining ½ million cubic feet each 24 hours!.

"Hats off to Mayor Rivers, whose determination not to interfere in the proceeding before the Board of Gas and Electric Light Commissioners respecting a reduction in the gas rate at Chicopee, Mass., is matter of record." So writes Mr. R. R. Brady, of Springfield, referring to the case respecting which the first sentence is explanatory. But, think of it, the Mayor, in extended further reference to the subject said: "I am confident that the question is in competent hands for settlement. The members of the State Gas and Electric Light Commissioners will do the right thing, I am sure, and even if Chicopee does not get the full reduction for the first 2 years, I believe that at the end of 2 years the rate in Chicopee will be the same as that in Springfield. Practically the Commission has assured us that if the merger takes place (the union of the Springfield and Chicopee Companies) the rate will be reduced immediately to $1.10 per 1,000 cubic feet, and that at the end of 2 years the rate will be further reduced to 85 cents, the same rate as the one in Springfield. I think that is fair, although I believe Chicopee should have the same rate as Springfield. The Commissioners though explained why this cannot be done at the present time."

At the annual meeting of the Consolidated Light and Power Company, of Whitehall, N. Y., the Directors elected were: Jas. A. Brady, W. E. Lewis, Samuel A. Beardsley.

Mr. H. E. Merrill, has been appointed Superintendent of the Missoula (Mont.) plant, and he proposes to extend the main systems considerably. He is quite well pleased with the outlook, although he confesses that it will be some time before Missou la is as important a trading spot as Spokane.

H. P. Hall, of Ann Arbor, Mich., and associates, have been granted a franchise to construct and operate a gas works in Brenham City, Tex. This syndicate is the one now engaged in putting in the plant at Waxahachie, Tex.

A reduction of 33⅓ per cent. in the selling rate of a comparatively small place does not seem possible, but such is the case at Superior, Wis., where on May 1st., the rate on all accounts-and-use will be $1 per 1,000. Now the rates are: Illuminating use, $1.40 per 1,000; fuel use, $1 per 1,000.

The Market for Gas Securities.

The gas share market on city account in the week was narrow in range, dull in tone, and lethargic as to motion. The result of the week's trading is to all intent a draw (that is in respect of Consolidated), the opening today (Friday) being returned at 143¾ to 144. The only bad spot in the situation, referring to the troubles in the coal field, does not look very raw just now, the labor situation never was better, in so far as the gas makers of this vicinity are concerned, and the demand for both gas and electric currents increases in satisfactory ratio, so everything points to the strengthening of values. In this circumstance and state, Consolidated and Brooklyn Union are good purchases at quoted rates.

In out-of-town gas securities apathy is a prominent feature, although prices are fairly well upheld. The annual meeting of the U. G. I. Company will be held at the home offices, at noon, the 6th prox. A President and 6 Directors are to be elected. A prominent Philadelphia capitalist said to the writer of this article recently that shareholders in the huge gas corporation of the Quaker City might hear of something quite to their advantage after the annual had been held.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

APRIL 22.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$73,177,000	100	143¾	144
Central Union Gas Co. —				
1st 5's, due 1972, J. & J.	8,000,000	1,000	103	105
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	8,500,000	100	165	175
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102½
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	109
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	142½	144
1st Con. 5's, due 1948, M. & N.	15,000,000	—	105¾	107
Yonkers	299,650	509	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	½	¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	509,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,680,000	1,000	104	105¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,682,750	100	90½	91
Preferred	3,036,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084	—		—
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore				
City, 4½	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
Detroit Gas Co., 5's	881,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100½
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	130	138
" Bonds, 5's	10,500,000	—	101	106
Indianapolis	2,000,000	—	—	38
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	91	95
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	99	102
Laclede Gas Co., St. Louis	10,000,000	100	106	106¼
Preferred	2,500,006	100	114	120
Bonds	10,000,000	1,000	102¾	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	108¾
Massachusetts Gas Companies, of Boston	25,000,000	100	90	90¼
Preferred	25,000,000	100	97	97½
Montreal Gas Co., Canada	9,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	108⅝	108¾
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
Pacific Gas and Electric Co.	15,500,000	—	56	57
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	105
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,600,000	200	425	427½
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 16 to 18, 1912. Marlborough-Blenheim Hotel, Atlantic City, N. J. Officers: President, Ira C. Copley, Aurora, Ills. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting and Gas Show, Toronto, Aug. 26th to Sept. 7, 1912. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keilior, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1912. Officers: President, R. M. Searle, Rochester, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Gas Meters.—Monthly meetings. Chairman, I. W. Petty; Secretary, H. Thurston Owens, 42 Pine street, New York City.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, time, March 19th and 20th, 1913. Chicago, Ills. Officers: President, H. O. Channon, Quincy, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting, Sept. ——1912, —— Meetings of Sections, monthly. Pres't, V. R. Lansingh, New York City; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York, Secretary, Albert J. Marshall, 16 East 40th street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, Edward Wray, 106 N. LaSalle street.

Indiana Gas Association.—Annual meeting, March, 1913, Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, time, May, 22, 23 and 24, 1912; Lincoln, Neb. Officers: President, G. W. Clabaugh, Omaha, Neb.; Secretary and Treasurer, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, time, Oct. 17-19. Manhattan, Kas. Officers: President, B. F. Eyer, Manhattan, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association—Annual meeting, time, Sept. ——1912;—— Officers: President, F. W. Blowers, Kalamazoo, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1913; Joplin, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting, Dec. 2-5, 1912. Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, May 21-23, 1912, Kansas City, Mo.; Officers: President, A. B. Macbeth, Independence, Kas, Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, ——1913. Boston. Officers: President, D. D. Barnum, Worcester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Spring Meeting, April 25, Lakewood, N. J.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn, Belmar, N. J.

Ohio Gas Association.—Annual meeting, February ——, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—President, Noel R. Gascho, Alva Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Diego, Cal., September 17, 18, 19, 1912. Officers: President, W. Baurhyte, Los Angeles, Cal.; Vice-President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, John A. Britton, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, York, Pa., April, 1913; Officers, President, H. H. Ganser, Norristown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 13, 1912; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, April 17-19, 1912, Jacksonville, Fla. Officers: President, H. B. Hoyt, Jacksonville, Fla.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. April 25, 26, 27, 1912, San Antonio, Tex. Officers: President, J. E. Carroll, Beaumont, Tex.; Secretary, D. G. Fisher, Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May 15 and 16, 1912, Milwaukee, Wis. Officers: President, H. M. Buck, Waukesha, Wis.; Secretary-Treasurer, Henry Harmon. Milwaukee, Wis.